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March 1998

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BEST PRODUCTS OF 1997

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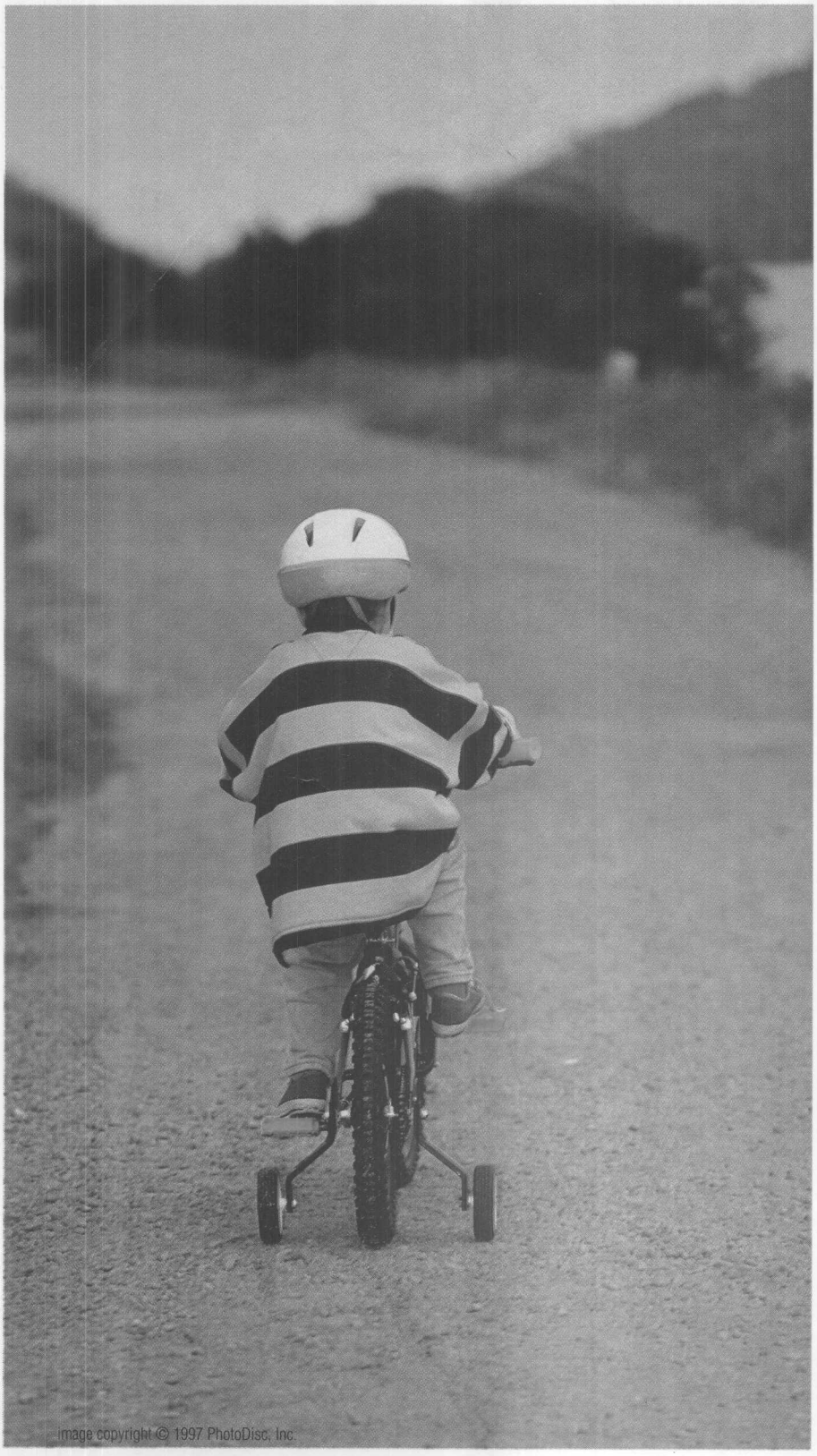
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UP FRONT

Siebe plc to Purchase Wonderware Corp. for $375 M

Irvine, Calif.—Wonderware Corp. and Siebe plc (Windsor, Berkshire, U.K.) announced an agreement Feb. 24 in which Siebe will acquire Wonderware for $24 per share, or about $375 million. The offer has already been unanimously approved by Wonderware's board of directors. Siebe plc is expected to initiate a cash tender offer soon and complete the sale in April 1998. "We're excited about the opportunity this acquisition gives Siebe to further expand our Windows NT-based industrial automation software product range," says Allen Yurko, Siebe's managing director and ceo. "Acquiring Wonderware and its high growth FactorySuite software products will clearly complement our already strong software position in batch and process applications, providing Siebe with the broadest range of both UNIX and Windows NT software for the industrial automation market." Siebe plans to finance the acquisition of Wonderware with existing lines of credit. Leading subsidiaries of Siebe Control Systems include Foxboro, Barber-Colman, Triconex, and APV.

In addition, Wonderware and Moore Products (Spring House, Pa.) reaffirmed their existing alliance following Wonderware's acquisition by Siebe. "Moore and Wonderware have an effective strategic alliance based on the open standards-based integration of Wonderware technology with Moore's process control systems," says Dr. George Sarney, president and ceo of Siebe Controls Systems Division. "We want to ensure that this acquisition has not negative impact on the relationship."

Halliburton Buying Dresser Industries in $7.7 Billion Stock Merger

Dallas, Tex.—Halliburton Co. and Dresser Industries Inc. announced a $7.7 billion merger Feb. 26, which they say will create an oilfield services and engineering and construction company with the broadest range of services to the petroleum industry worldwide. In an agreement approved by the boards of both firms, Dresser shareholders will receive one new share of Halliburton common stock for each Dresser common share. Based on Halliburton's Feb. 25 closing price, the transaction is currently valued at $44 per Dresser share for a total of $7.7 billion. The transaction will be accounted for as a pooling of interests and is expected to be tax-free to Dresser's shareholders. The companies' 1997 combined revenues exceeded $16 billion and their combined market capitalization is over $19 billion. Dick Cheney, Halliburton's chairman and ceo will be ceo of the combined company. William Bradford, Dresser's chairman and ceo, will become chairman of Halliburton. The transaction is expected to be completed in the fall of 1998.

U.K.-based Eurotherm plc Acquiring Action Instruments

San Diego, Calif.—Action Instruments Inc. announced Feb. 6 that it is being acquired by U.K.-based Eurotherm plc, the world's largest manufacturer of industrial temperature controllers. Subject to FTC and shareholder approval, the purchase was expected to be completed by the first week of March 1998. A leading manufacturer of industrial measurement and control instrumentation products for factory automation and process controls, 25-year-old Action Instruments has annual sales of approximately $20 million—with about 75% in the U.S. Action has been seeking growth through international expansion, and this led to the acquisition by Eurotherm. "At mid-size, in a fragmented marketplace, Action has been seeking growth acceleration through international sales and increased investment for technology development in the emerging industrial-network I/O markets. Eurotherm has the core technology and sales channels to accelerate Action's growth in Europe," says Jim Pinto, Action's founder and president. Mr. Pinto will become Action's chairman. Frank Williams, Action's vp of marketing, will become Action's president and ceo.

Computer Technology Corp. Bought by Parker Hannifin Corp.

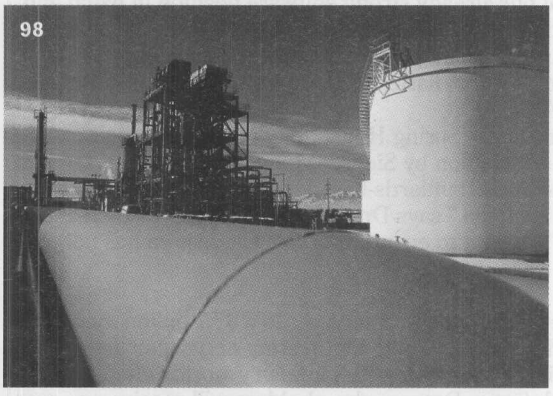
Milford. O.—Computer Technology Corporation (CTC) announced Feb. 27 that its stock has been purchased by Parker Hannifin Corp. (Cleveland, O.) for an undisclosed sum. Albert Vierling, CTC's founder and president, stated that, "Parker's commitment to technology, quality, and worldwide service aligns perfectly with our goals of providing customers with leading edge solutions for both MMI and control." A leading human-machine interface manufacturer, CTC will be an operating division of Parker's $550 million worldwide Automation Group, and will continue to operate from its current location. No personnel changes are planned. John Oelslager, president of Parker's Automation Group, adds that, "The CTC acquisition will give Parker a man-to-machine interface line of both hardware and software products that will take us to the next level in the motion control industry."

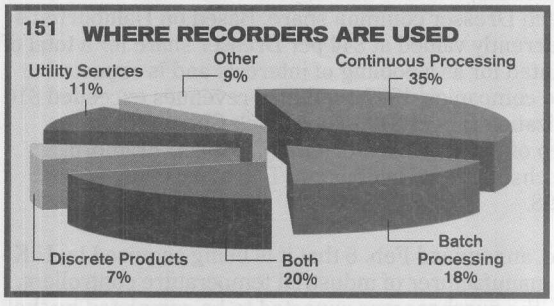
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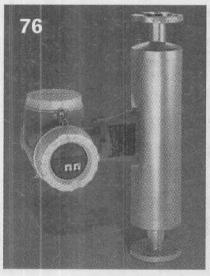
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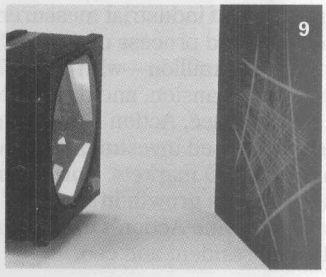
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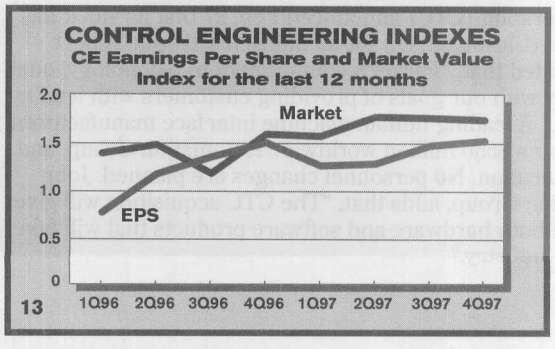
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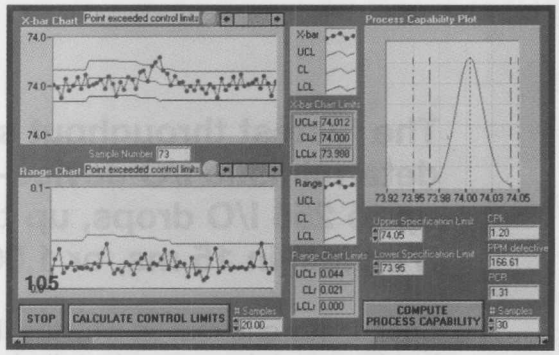
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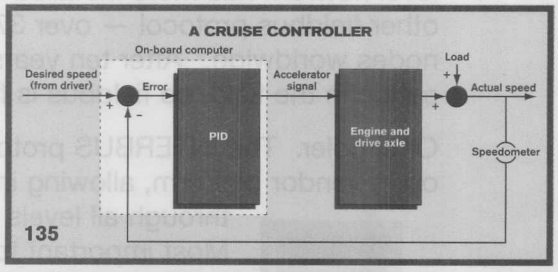
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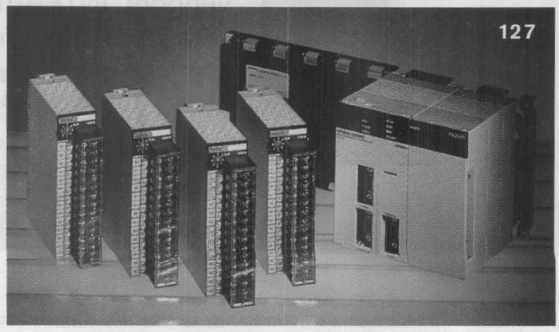
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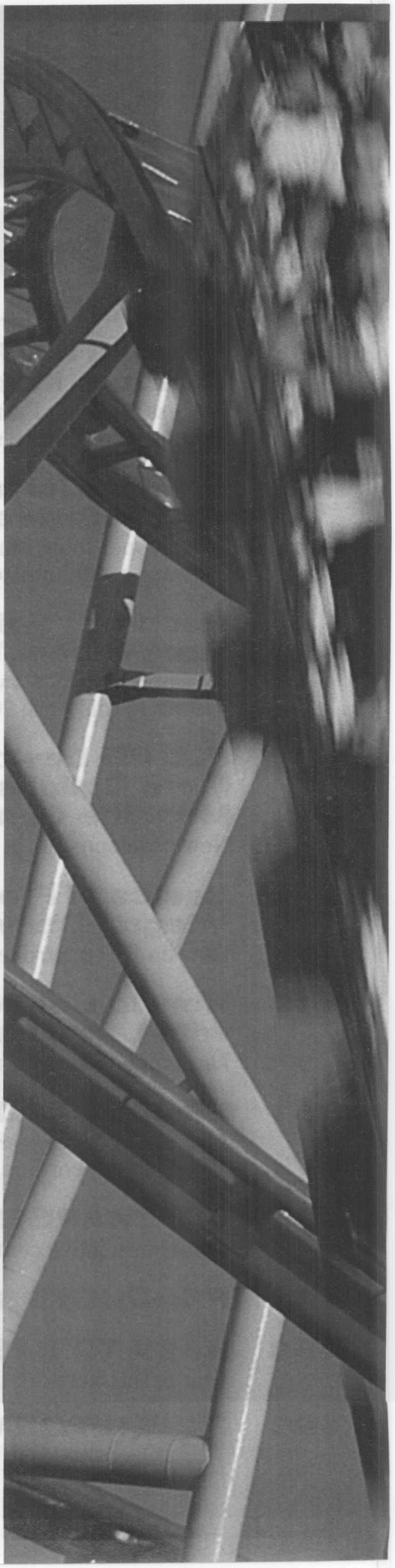








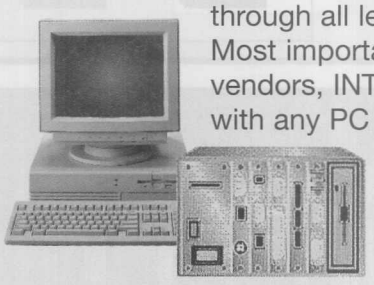
Like the feel of speed?



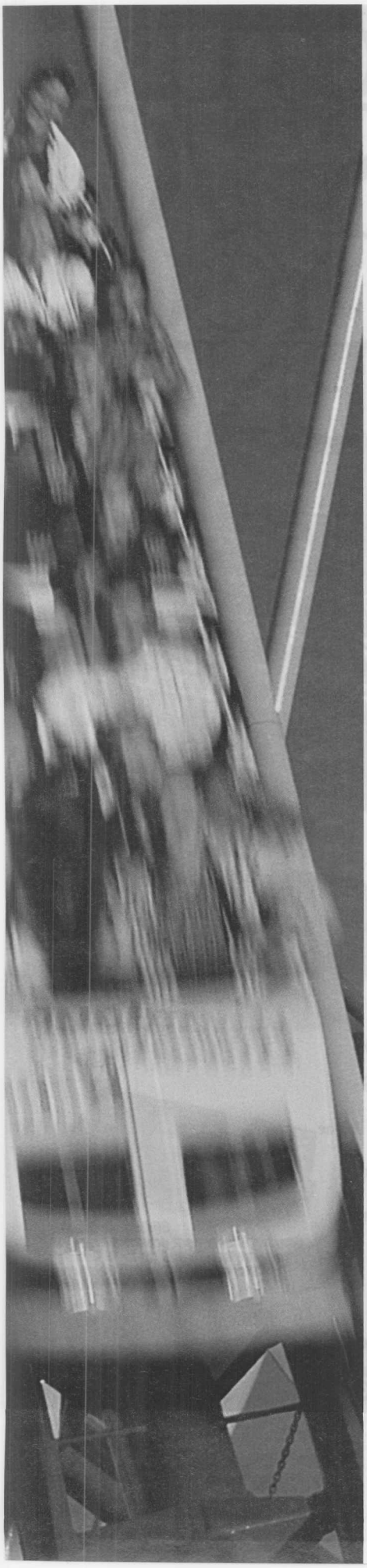
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*1997 independent market study by Automation Research Corporation (Dedham, MA, USA)



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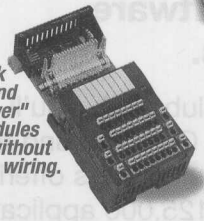
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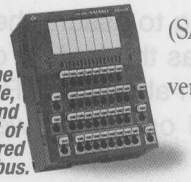


Hinged back plate and "works-in-a-drawer" allow modules to be replaced without disturbing wiring.

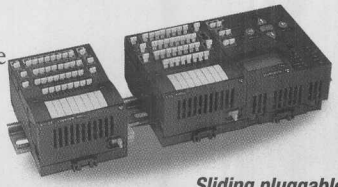


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Holographic Lens Lets Bar Code Reader Scan in Any Direction

Is your bar code reader illiterate? It might seem that way to some control and automation engineers, not to mention supermarket shoppers. However, many readers simply bog down when struggling to read labels that aren't lined up straight.

To lessen this traditional problem, Rockwell Automation recently introduced its Allen-Bradley StrataScan Bar Code Reader, which uses holographic technology to produce an omnidirectional scan pattern to interpret random-label applications.

"In traditional line scanning applications, bar code labels must be aligned in a consistent orientation to ensure good reads by the bar code scanner," says Patty Roberts, Allen-Bradley Automatic Identification Products' marketing programs manager. "With StrataScan, labels can be read in virtually any orientation, and at varying depths of field—dramatically increasing application throughput and productivity."

StrataScan uses holographic lens technology to create multiple scan lines at different layers for a depth of field of up to 42 inches. Combined with a high-speed processor, StrataScan has read at speeds up to 300 ft/min.

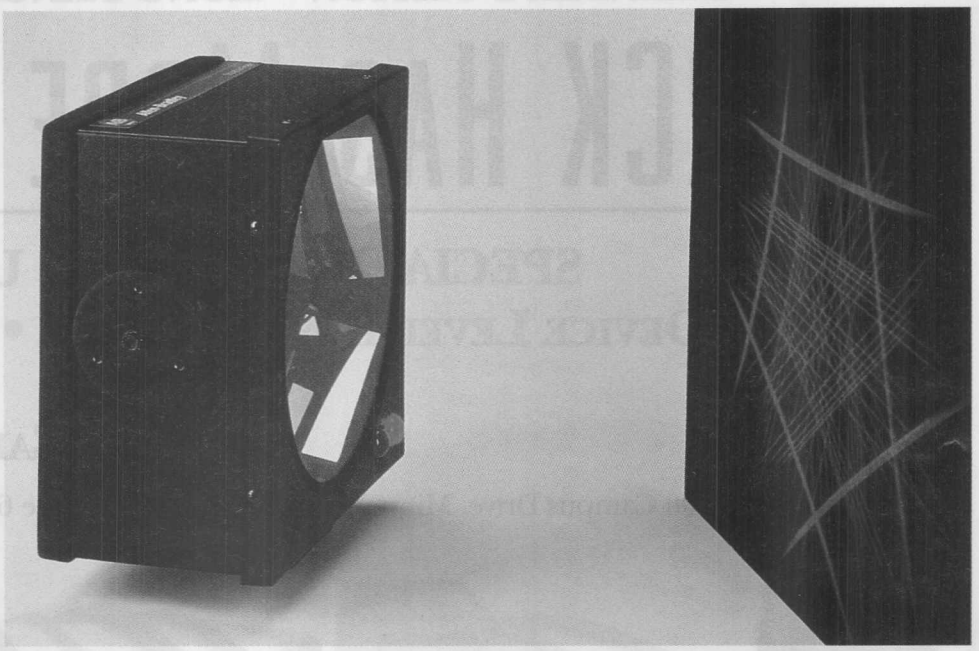
"Traditional scanners have defined depths, so the significant innovation here is that holography allows this new bar code scanner to read at multiple depths. This method may also be less expensive than trying to solve depth of field problems using a camera-based system," says Dan Mullen, vice president of technology for AIM USA, the Automatic Data Collection and Identification Manufacturers Association (Pittsburgh, Pa.). "For industrial users of many conveyor belt-based applications, this new scanner could mean they'll be able to maintain efficiency without having to be quite as precise when lining up items in their systems." Mr. Mullen adds that StrataScan could likely be used in shipping, receiving, warehouse, and other distribution and tracking applications.

StrataScan's only moving part is a single holographic disk that replaces the focusing lens, light collection lens, and the rotating or oscillating mirror used in standard laser scanners. As StrataScan's holographic disk rotates, the lenses on both the outbound and return paths focus up to five visible laser diodes to generate up to 105 scan lines per rotation. At 4,200 rpm, up to 7,300 scans lines are generated, which enhances scanning performance.

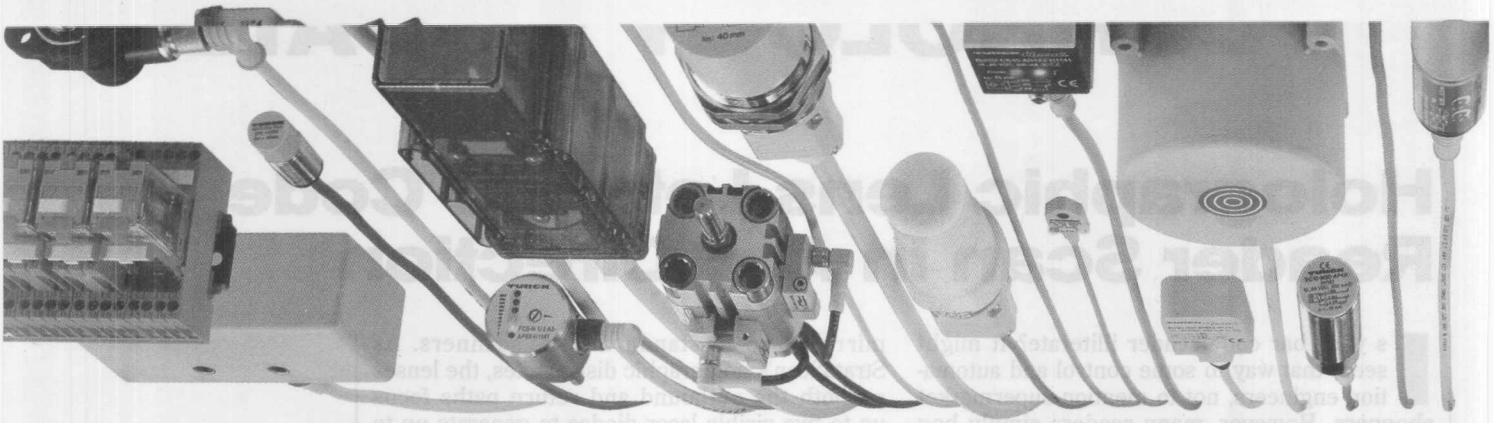
Unlike other omnidirectional readers, which usually have a cone shaped read area, StrataScan repeats the same scan pattern over multiple focal lengths. This produces a consistent read width from the top to the bottom of the read area. When a wider read area is necessary, users can connect other readers in a master/slave configuration to achieve greater read widths.

StrataScan can also decode the following symbologies: UPC-A, UPC-E, EAN 8, EAN 13, Code 39, Interleaved 2 of 5, Code 128, Code 93, Jan 8, Jan 13, and Codabar. With a starting price below $8,000, StrataScan has a port for an optional integral handheld scanner and connector for an I/O interface box with one input, one output, and a trigger port for a package detector.

For more information, Circle 368 or visit www.controleng.com/info.



Allen Bradley's new StrataScan bar code reader uses holography to scan in many directions and at varying depths of field.



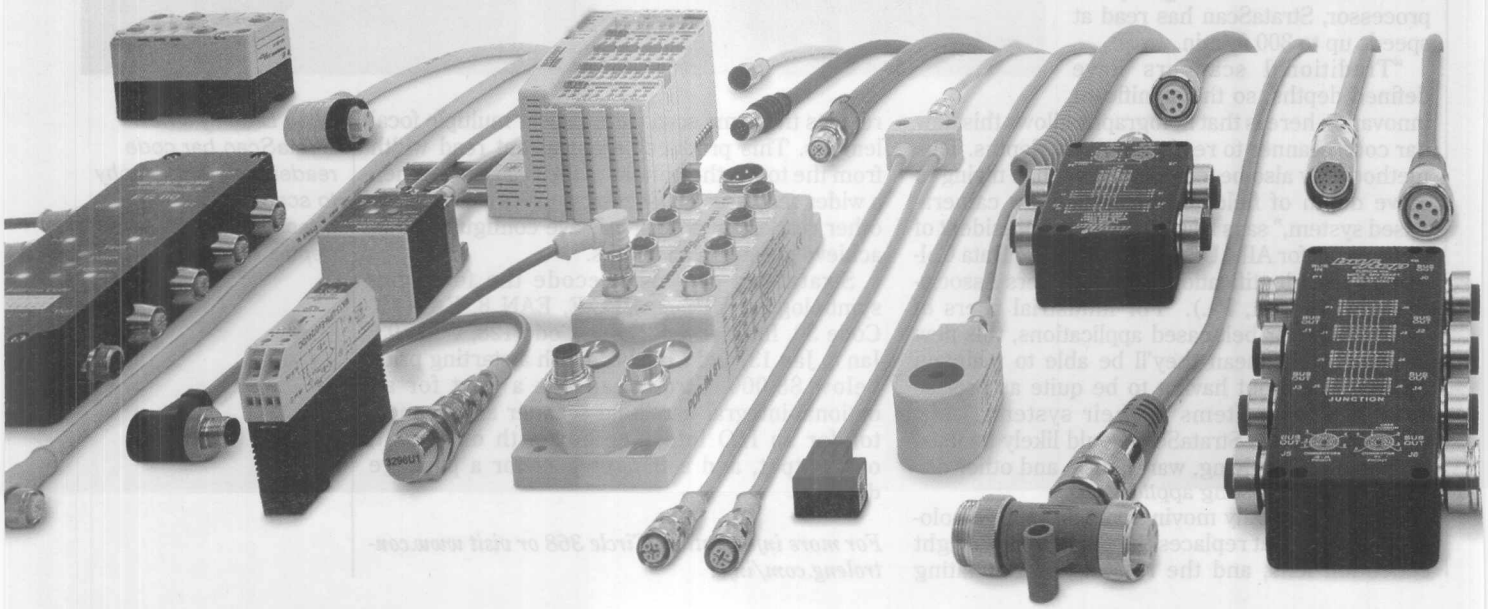
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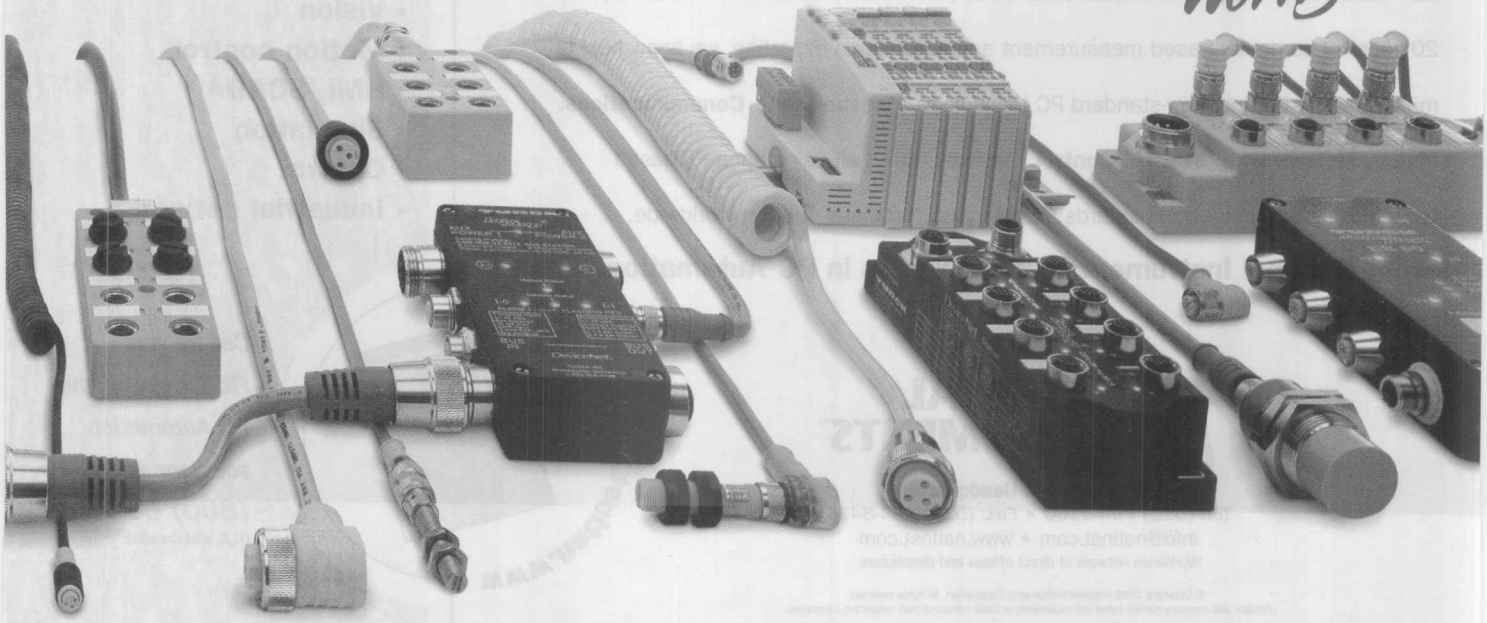
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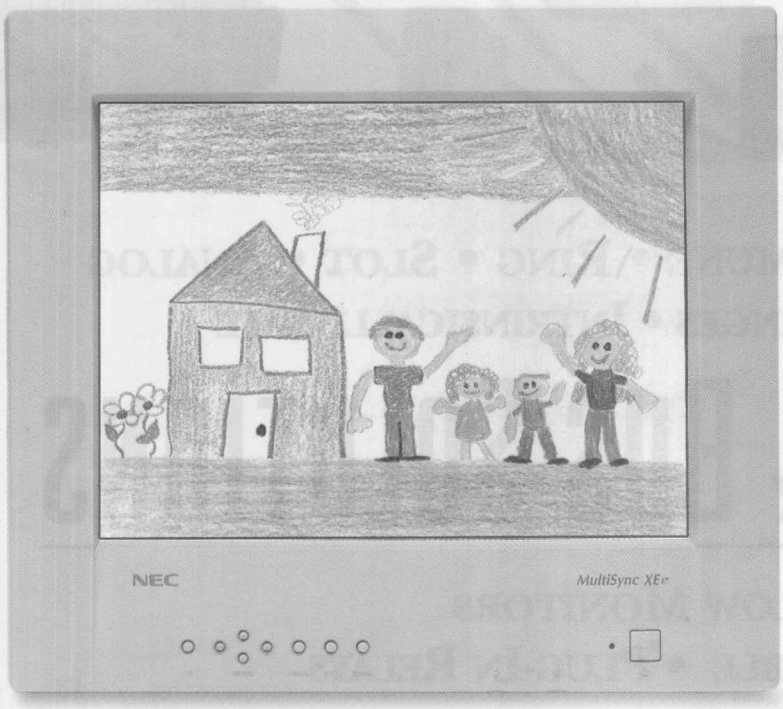
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For information circle **6**

Controls Industry Outperforms Other Markets

The industrial controls business in 1997 outdid even the volatile and booming stock market. Dancing around the 8,000 level, the Dow Jones Industrial Average (DJIA) and other market indexes managed to recover on "Turnaround Tuesday" most of the losses suffered on "Meltdown Monday" in late October. The general market indexes made gains of 20% to 30% for the year while the Control Engineering (CE) Index soared, gaining about 50%.

The big gains industrial controls made in market value in the second quarter carried over for the year. Even when the CE Index figures are dampened by factoring in both the stock price increases and decreases with the market value, the increase in quarter-to-quarter and year-to-year numbers are between 35% and 45%.

The CE Index was also recently adjusted to accommodate the acquisition of valve manufacturer Keystone International by Tyco International in 1997. Even the DJIA bounces some of its 30 stocks and replaces them when needed. Name changes also tend to confuse some indexes.

Tyco's addition increases the number of large companies in the CE Index. Keystone was small compared to Tyco, which ranks with Emerson, Honeywell, and Rockwell.

The earnings picture for industrial controls took a big dip in 1Q97 due to a negative performance by one company's stock and a big drop for another company, though it still achieved positive earnings overall. Both companies turned around later in the year, while most of the other companies secured either positive or improved results.

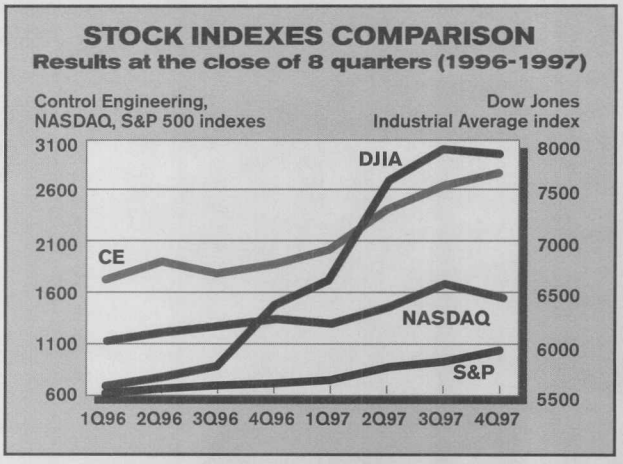
George J. Blickley, Consulting Editor

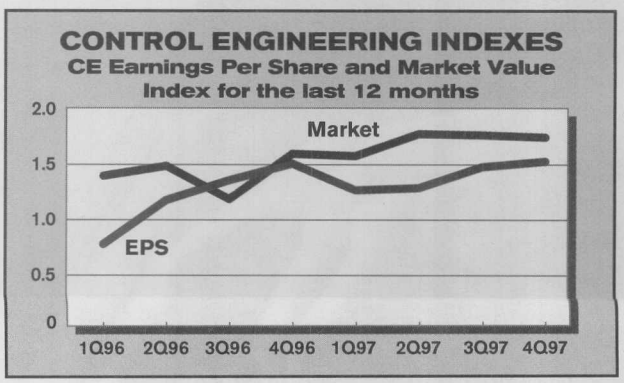
CONTROL ENGINEERING STOCK INDEX

Stock prices close 12/31/96	($) close 12/31/97	% chg. in year	52-wk. high	Annual div. yield	Price/ earn. ratio	12-month EPS($)
Ametek Inc. 22.25	27.00	21.35	28.00	0.74	18	1.52
Badger Meter Inc. 19.19	40.75	112.38	57.50	1.23	25	1.65
Daniel Industries 14.75	19.25	30.51	21.94	1.04	NC	0.00
Elsag Bailey Process 18.75	16.50	-12.00	21.75	0	275	0.06
Emerson Electric Co. 48.44	56.44	16.52	60.38	2.13	22	2.52
Honeywell Inc. 65.75	68.50	4.18	80.75	1.61	20	3.51
K-Tron Intl. 10.25	17.25	68.29	19.75	0	11	1.54
Moore Products Co. 18.00	37.00	105.56	39.25	0	22	1.69
National Instruments 21.33	29.00	35.94	33.63	0.00	31	0.95
Rockwell Intl. 60.88	52.25	-14.17	61.88	1.91	17	3.01
Transmation Inc. 5.13	8.50	65.85	9.88	0	280.	30
Tyco Intl. Ltd. 23.76	45.06	89.65	45.50	0.22	46	0.97
Wonderware 8.89	14.13	58.94	20.38	0	NC	-0.25

NC = Noncalculable or not meaningful EPS = Earnings per share Yield = Percent based on closing price Div = Dividend

Data: Nordby International Inc., Boulder, Colo.; Call 303/938-1877
Table: Control Engineering, Reed Elsevier Business Information





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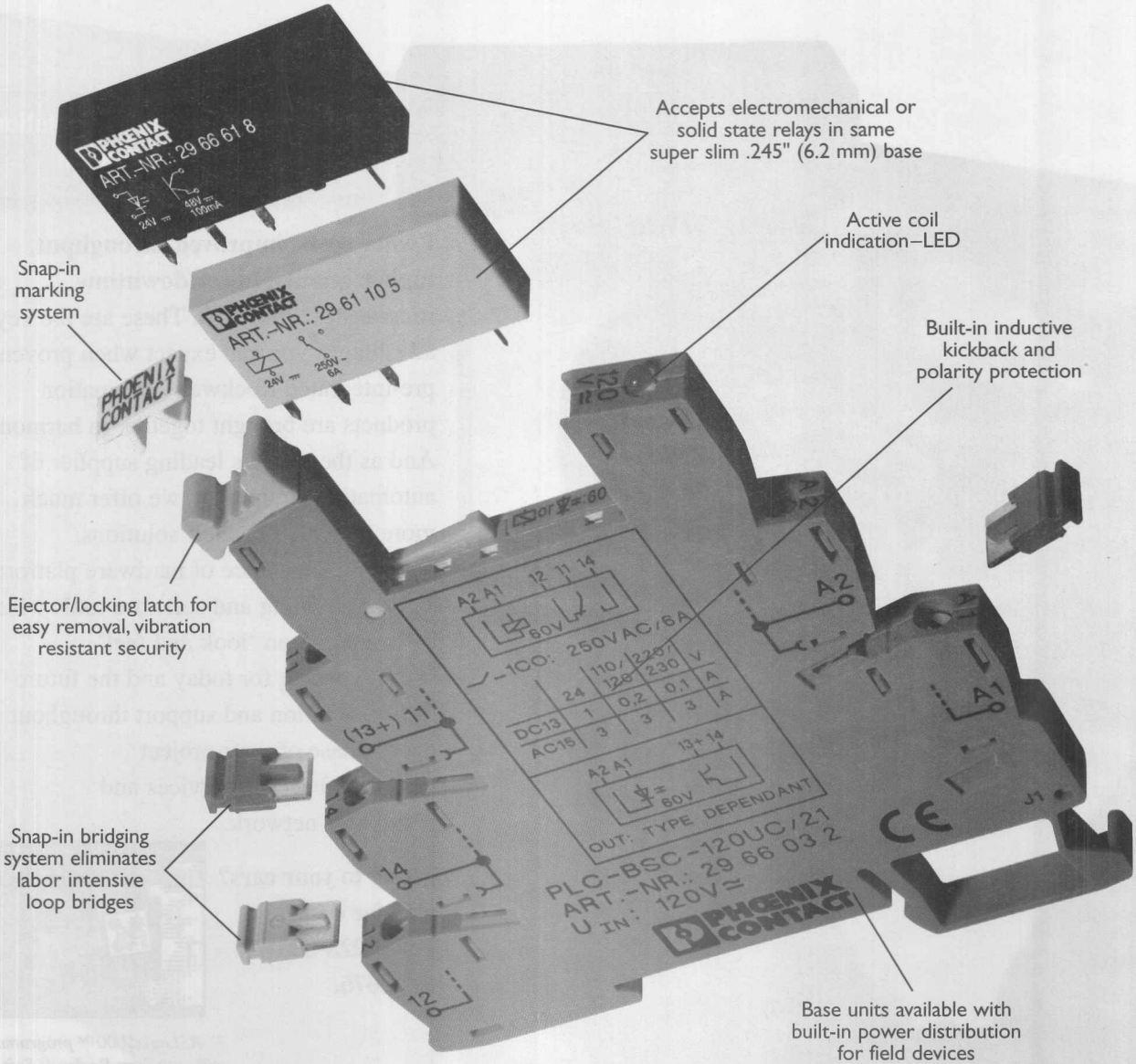
CONTROL
YOUR FUTURE TODAY

For information circle 7

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PHOENIX CONTACT

INNOVATION IN INTERFACE

For information circle **8**

EXCLUSIVE

DCS/PLC System Simultaneously Upgrades Plant, Cuts Costs

To do more with less is not an easy challenge. Luckily, some timely assistance is exactly what engineers at Engelhard Corp. (Attapulgus, Ga.) received recently when they sought to replace outdated control systems and reduce overall costs at their petroleum catalysts production plant.

Engelhard's staff was working to cut costs by $7 million per year, but also knew they had to replace the plant's obsolete control systems, which were in increasing danger of failing. Engelhard also had 13 control rooms throughout the plant. It's automation consisted of various loosely connected PLCs with eight different human-machine interfaces (HMIs) and several single- and multiple-loop controllers. All of these collected information separately and presented it in different formats.

Faced with a potentially costly upgrade, Engelhard's engineers projected that centralizing operations and using innovative control technology might lower operating and maintenance costs.

To accomplish these tasks, as well as consolidate process control data collection and presentation, Engelhard's engineers eventually selected an APACS process control system from Moore Products (Spring House, Pa.) for control and an InTouch operator interface from Wonderware Corp. (Irvine, Calif.) for monitoring. Engelhard's new Microsoft Windows-based system is a seamless network of over 1,000 I/O points, main and satellite control rooms (with eight and two operator stations respectively), two engineering workstations, 25 PLCs, and a variety of transmitters.

The APACS unified DCS/PLC system has an integrated set of tools for controller configuration. Based on the IEC 1131-3 standard, APACS provides four PLC programming languages that can be used and combined as needed within a single database. These languages include: function blocks, ladder logic, sequential function chart, and structured text. Engelhard's engineers say a primary reason they picked APACS is because its graphical format was easy to learn.

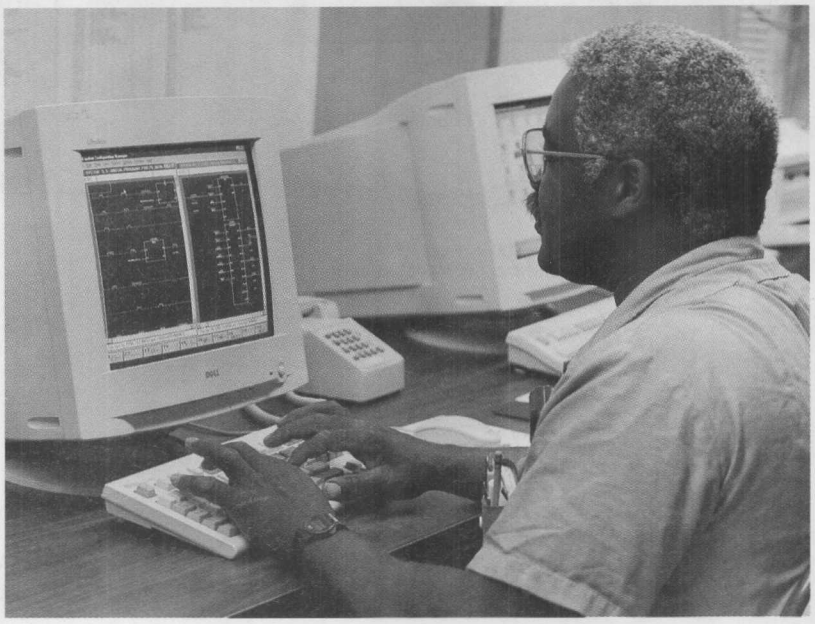
APACS' ability to combine four languages in one control strategy slashed Engelhard's configuration design time. When creating functions, for example, engineers substituted up to eight rungs of ladder logic with one function block. The software's cut, copy, and paste abilities also allowed engineers to duplicate and replace redundant strategies as needed to control interlocking requirements on the plant's transporter diverter valves.

Engelhard's combined APACS and InTouch system and its graphical form helped the engineers view their configuration on-line. "We can actually see what's going on and force values within the control strategy, which really helps in troubleshooting the configuration. Before APACS, we really couldn't access this information at all," says Buster Terry, one of Engelhard's instrument technicians.

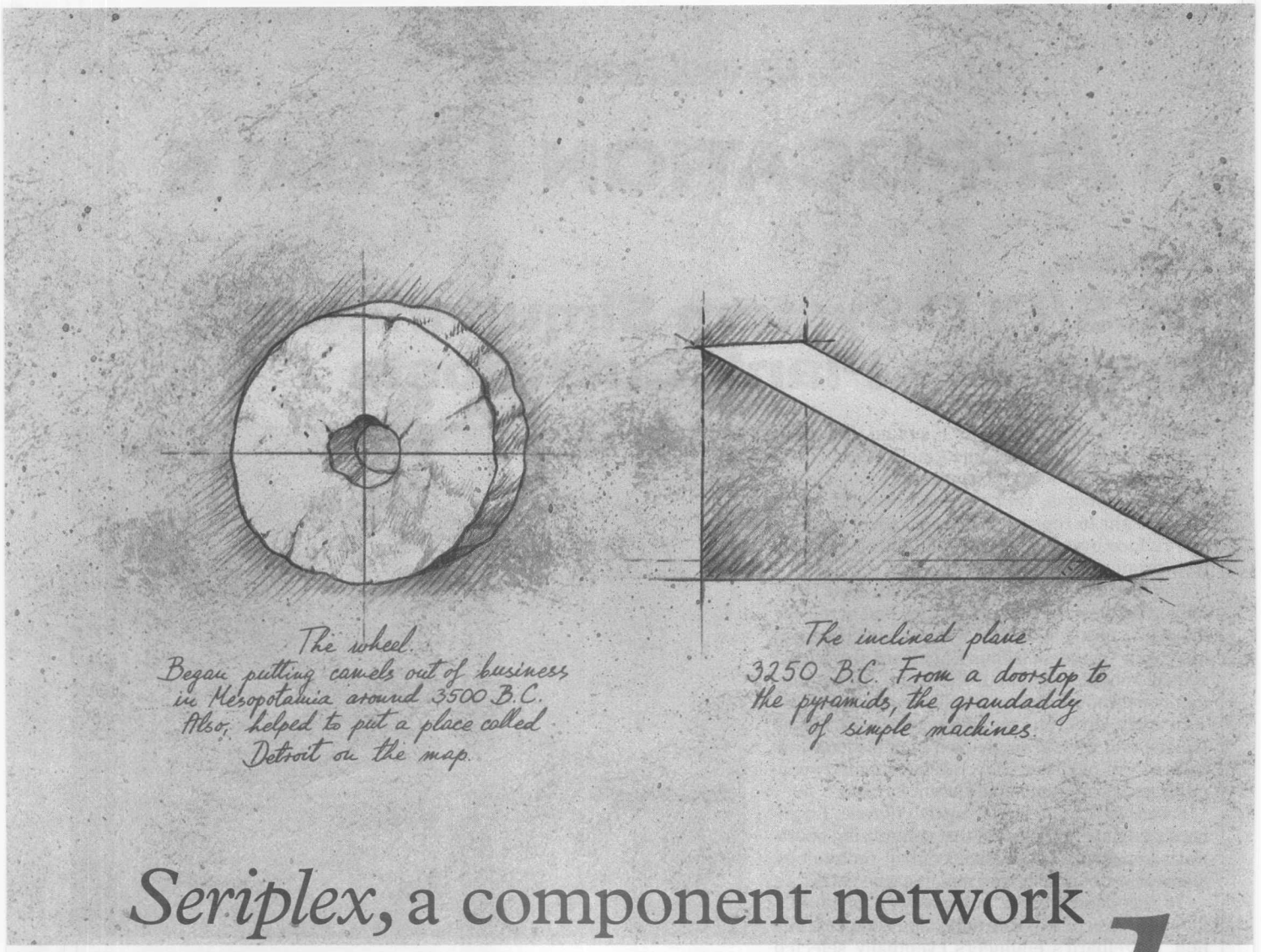
InTouch's development tools—such as object-oriented graphics, animation links, distributed alarming, and Wizards library of preconfigured objects—further reduced typing time, and this helped engineers create operator screens more efficiently. Training new users was also easier because Engelhard now had one plantwide HMI.

Engelhard's engineers also reported an unexpected bonus. Implementing APACS and InTouch didn't require any unscheduled downtime. And, as they hoped, the new control system has already reduced maintenance costs because errors and field failures are much easier to pinpoint. Engelhard's future plans include setting up an enterprise resource planning system that can run Microsoft Windows NT and communicate with the control system, as well as adding Internet functionality later.

For more information, Circle 499 for Moore Products, Circle 500 for Wonderware, or visit www.controleng.com/info.

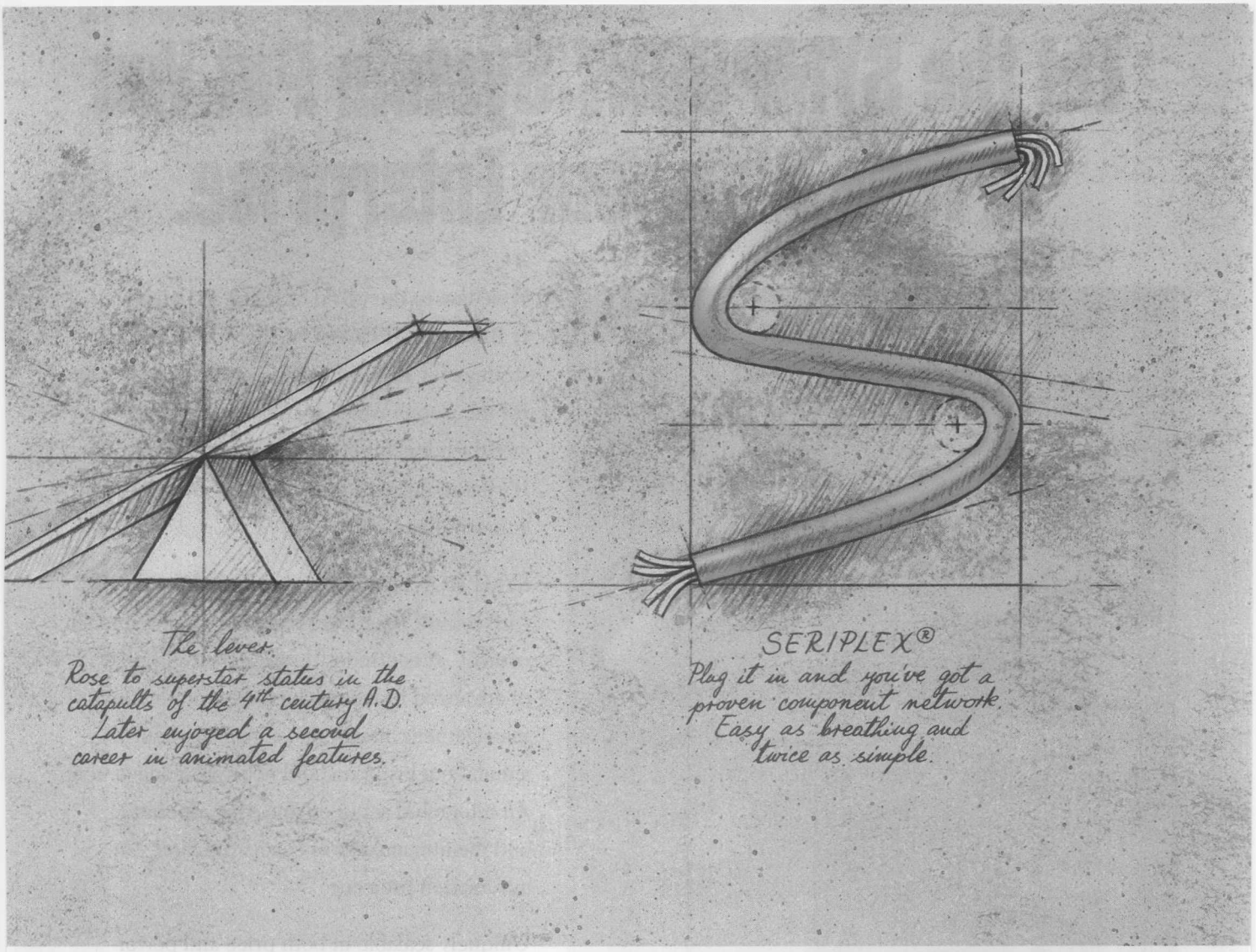


Maintenance technician Harold Huggins tests Engelhard's control strategy in the configuration software's off-line mode. Integrating Moore Products' APACS and Wonderware's InTouch software allows Englehard's staff to fine tune the control strategy and operator screens as they go.



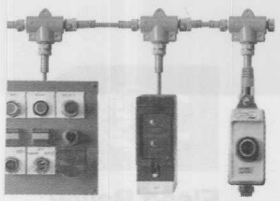
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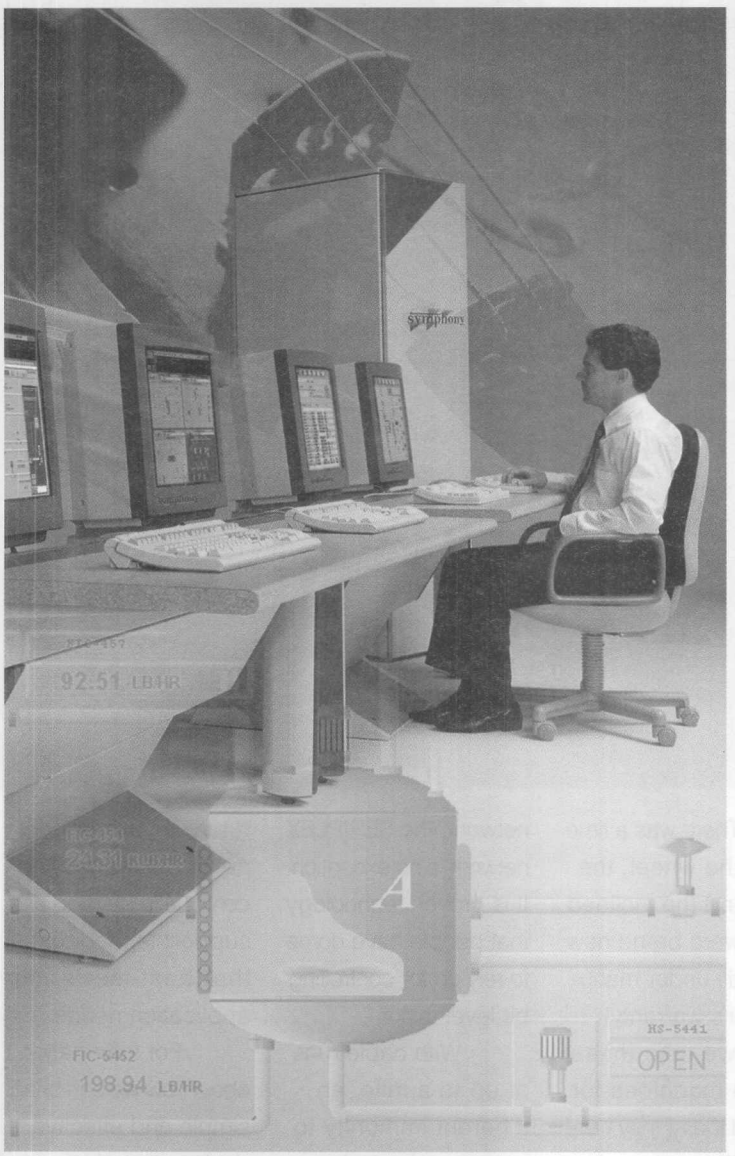
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For information circle 9

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For information circle **10**

Project Management Becomes Another Path for Engineers

Engineers seeking to advance incomes and responsibilities within the same company typically have had two options: advance in technical knowledge or become part of management. With management running leaner than in the past, these opportunities may be fewer, or more competitive, for engineers.

A third option exists in many settings—project management.

"Historically, there have been only two ways for engineers to earn larger salaries," according to Dr. Harold Kerzner, professor of Systems Management at Baldwin-Wallace College (Berea, O.).

"They can show that their efforts directly contribute to corporate profits, or that they control vast resources within the company. Both are very, very hard to do in today's world. But if companies give project managers responsibilities for profits and losses, they can show their efforts directly contribute to profitability."

Higher risks, rewards

That means bringing product managers on board earlier in the automated process to do cost feasibility studies and cost-benefit analyses. In the past, Dr. Kerzner says, accountants had performed those functions, consulting with engineers often too late in the process, and requiring them to live with the results. Having the experts—the engineers—do the analysis can result in the project being treated as a profit source, rather than just an expense. This can translate into higher profiles, higher risks, and higher rewards for project managers.

"At many technology companies, engineers were locked behind closed doors, and not allowed to interact with customers," says Dr. Kerzner. Now, he explains, cultural changes are creating project management responsibilities for engineers, who are making critical business decisions earlier in the process, and interacting with sales, customers, management, and other engineers.

Twenty years ago engineers' successes were based solely on technical expertise—did the product work or not. Today, many engineers are also taking the lead to ensure the project is delivered on time, within cost, within quality parameters, and accepted by the ultimate customer or user.

"Project management, as a career path, bridges traditional management and technical ladders." Engineers advance in the project management track by demonstrating an ability to work with people and make sound business decisions, Dr. Kerzner says. A valued project manager for an automation installation, for instance, would ensure the line was properly installed, on time, within budget, and operators had the appropriate documentation and training.

Pay attention

In most companies, business knowledge, rather than all-encompassing command of the technology, is essential. Engineers that have been in a company for a while may have picked up more business knowledge than they realize. Knowing how things work and having connections within a company may be more useful than hiring or contracting with an outsider. Other key skills include risk management, integration skills, and people skills.

Getting a general sense of business can be the toughest part for some engineers used to sticking to the technology, says Dr. Kerzner, who also teaches through International Institute for Learning (New York, N.Y.). As a result, many engineers, may seek additional business-related training, but not necessarily an MBA (a masters degree in business administration). A smaller educational in-vestment, in project management, is available, from several sources. Applicable books include Dr. Kerzner's latest, "In Search of Excellence in Project Management," published in November 1997 by John Wiley Publishers (New York, N.Y.).

More formal education includes institutions, like Baldwin-Wallace College, or seminars, videos, and even satellite broadcasts. Also, certification is available for project managers via a national exam. The Project Management Institute (Upper Darby, Pa.) has a 13-year history of project management professional (PMP) certification, Dr. Kerzner says; membership exceeds 30,000, which "just scratches the surface."

For more information Circle 373 or visit www.controleng.com/info.

Mark T. Hoske, managing editor, mhoske@cahners.com

PROJECT MANAGEMENT BASICS

- Define objectives: What's the project's history and evolution? What constitutes success or failure? What are the risks?
- What resources are available? Who's allocating them? Can the project be handled informally?
- Evaluate team members' expertise/skills/styles and decide who's accountable for what.
- Establish authority and job descriptions.
- Consider corporate culture and how it may influence project goals.
- Define the level of management support: Do project team members have management's sponsorship or just its trust?
- Is additional education/training needed for team members, or for others in the organization?
- Develop scope of decision-making ability and decide how problems will be resolved.
- When is the project finished?

Source: International Institute for Learning, New York, N.Y., and Control Engineering

SIEMENS

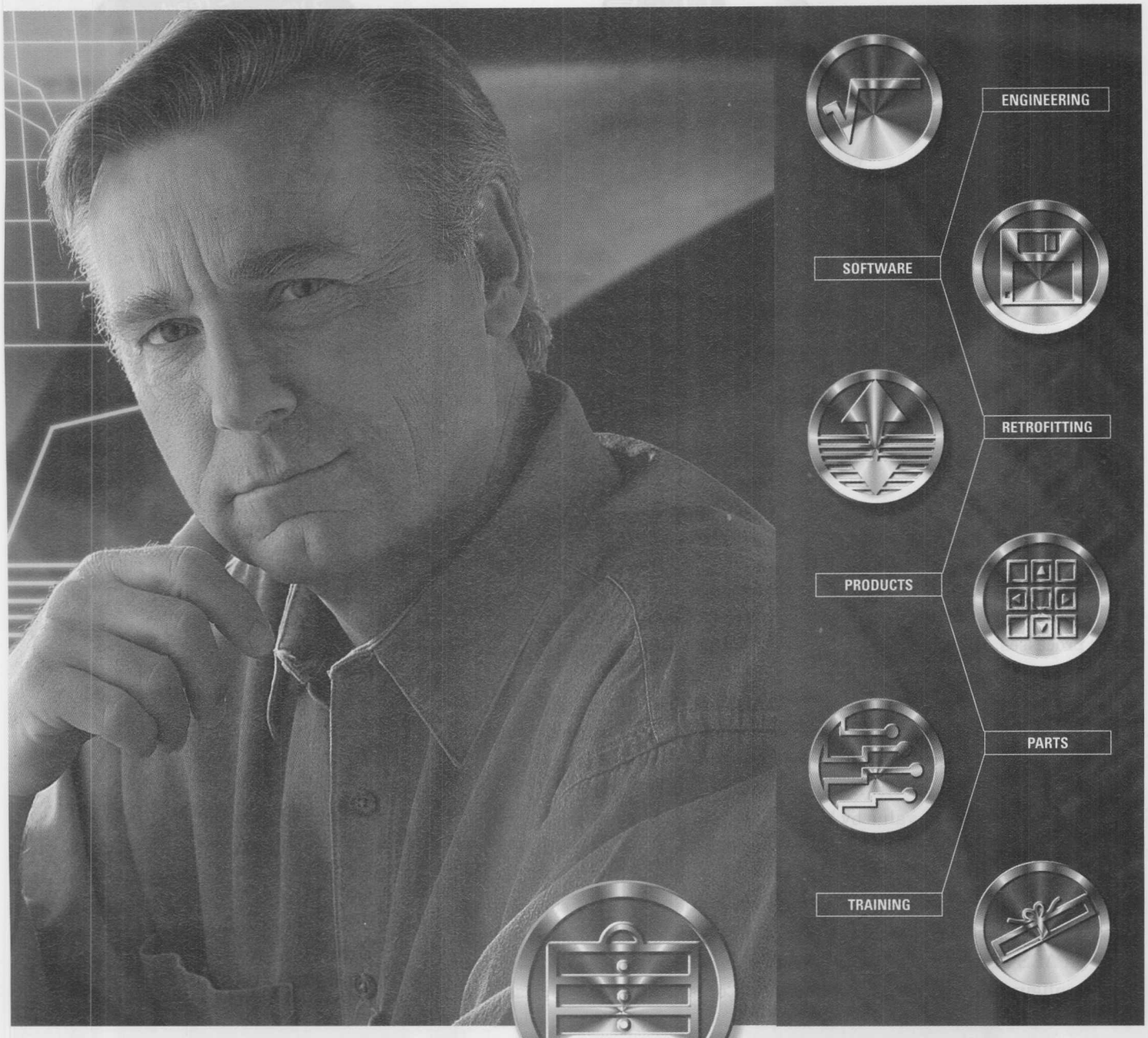


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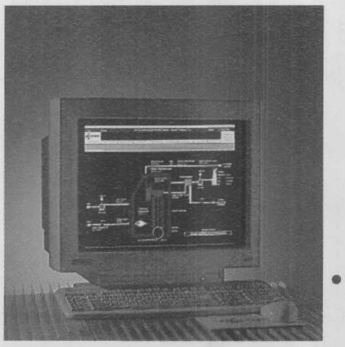


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APACS ProcessSuite's integrated software complements the APACS system's unified DCS/PLC capabilities.

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For information circle **12**

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GLOBAL UPDATE

Fisher-Rosemount Launching FOUNDATION Fieldbus Products in U.K.

London, U.K.—Kevin Jackson, Fisher-Rosemount's U.K. managing director, says his London-based company will have a "complete suite" of FOUNDATION Fieldbus products available in 1998, following "rigorous testing" in production processes. "We're looking forward to starting the real world business of introducing end users to the immense benefits of products on FOUNDATION Fieldbus protocol," he says. "This is undoubtedly the best and only bus for process applications." Mr. Jackson cites "true interoperability" and "Device Description technology" as the two major factors for selecting FOUNDATION Fieldbus. Device Description technology, he says, will allow end-users to "accommodate future innovations with no loss of interoperability." "Unlike regional standards, or those dominated by a single supplier, FOUNDATION Fieldbus is supported by every major process automation supplier in the world," says Mr. Jackson. In Paris, Jean-Pierre Hauet, Cegelec's chief technical officer, and John Berra, president of Fisher-Rosemount, recently announced their companies will integrate Fisher-Rosemount Smart Field devices and AMS software into Cegelec's Alspa 8000 control system.

Handwriting on Wall for Hard Disks?

Tel Aviv, Israel—Flash memory technology is starting to catch up with industrial computer users, many of whom never liked the idea of using rotating magnetic discs on the factory floor. Flash memory chips—produced mainly by AMD and Intel—have increased storage densities so rapidly over the past months that it is now possible to offer 72 megabytes in a single 32-pin part, according to Aryeh Mergi, executive vp of M-Systems. In fact, he adds that M-Systems' "DiskOnChip" product will likely double its capacity in the next year. Until now, M-Systems' major customers have been PC motherboard and single board computer manufacturers. M-Systems is the leading packager of flash memory units for computers. To make its modules more acceptable to computer manufacturers, the company developed flash translation layer (FTL) software which makes flash memory behave exactly as if it were a hard disk drive. Mr. Mergi says FTL is so popular that it has become a *de facto* standard and Microsoft has announced it will support FTL software in the next major release of Windows CE.

Foxboro Grows in Asian Environmental, Power Markets

Foxboro, Mass.—The Foxboro Co. and Siantek, it's representative in Taiwan, recently received a multimillion-dollar order from Mitsubishi Heavy Industries, Ltd., Japan, and CTCI Corp., Tawain's largest engineering contractor, to install its I/A Series control system at two refuse incinerator plants (Kaohsiung South and Ren-Wu) for the Environmental Protection Administration, Government of Taiwan, Republic of China. Foxboro's scope of supply includes the I/A Series control system, engineering services, panels, and field services. The I/A Series system will control burning of all refuse in Kaohsiung, Taiwan's second largest city. Electricity generated by refuse burning will be exported to the power supply grid of Taiwan Power, the national electric utility. Support of the local language was strictly requested by the customer for this project, and Foxboro reports that it won the order based largely on its "Asianzation" effort. The company was able to support Taiwan's Chinese language as a standard because the I/A Series can support multi-language environments.

FieldComms Conference Moving to Telford

Titchfield, U.K.—FieldComms U.K. organizers say they're moving their fieldbus-oriented conference and exhibition to the Telford Exhibit Centre on Oct. 28-29, 1998. The event has been held for the last three years at a hotel. Visitors to the 2.5 day event attend a tightly integrated program of conferences, tutorials, and workshops, as well as a small exhibition. "FieldComms always attracts a large number of delegates looking to make early strategic purchasing decisions on fieldbuses," says Derek Lane, Wago's systems product manager.

BIAS '98 Plans 'Executive-Level' Roundtable

Milan, Italy—The BIAS '98 trade fair will stage a "first-time-ever" roundtable of process industry ceos to discuss challenges faced by instrument and control systems manufacturers, according to Antonio Rampini, BIAS' organizer. He said ABB Group, Elsag Bailey Process Automation, Honeywell, Siemens AG, and Yokogawa have confirmed their participation in the event. BIAS '98 will be held in Milan, Italy, on Nov. 24-28. The event was originally scheduled for two weeks earlier, but the dates had to be changed because of a conflict with the Electronica event in Munich, Germany. "Roundtable discussion will be focused on trends and market perspectives rather than on instrumentation technology, to give a clear message to end-users and to the institutional investors," said Mr. Rampini. The meeting coordinator will be the director of the Il Sole 24 Ore, Italy's economic-financial newspaper. He said some major multinational end-users, as well as officials from the Italian Ministry of Industry and the Council Committee of the Italian Industry Association, would also be invited.

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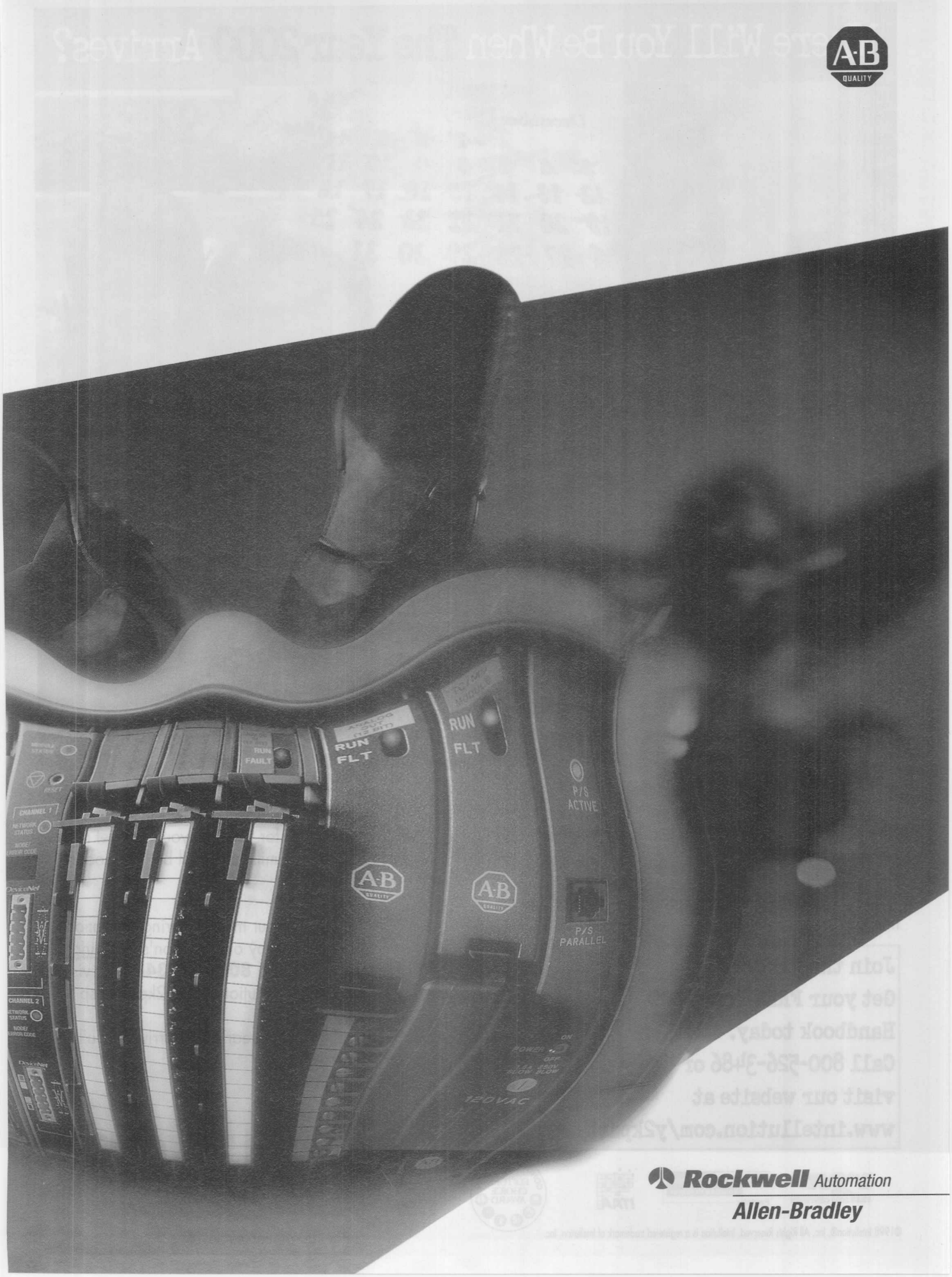
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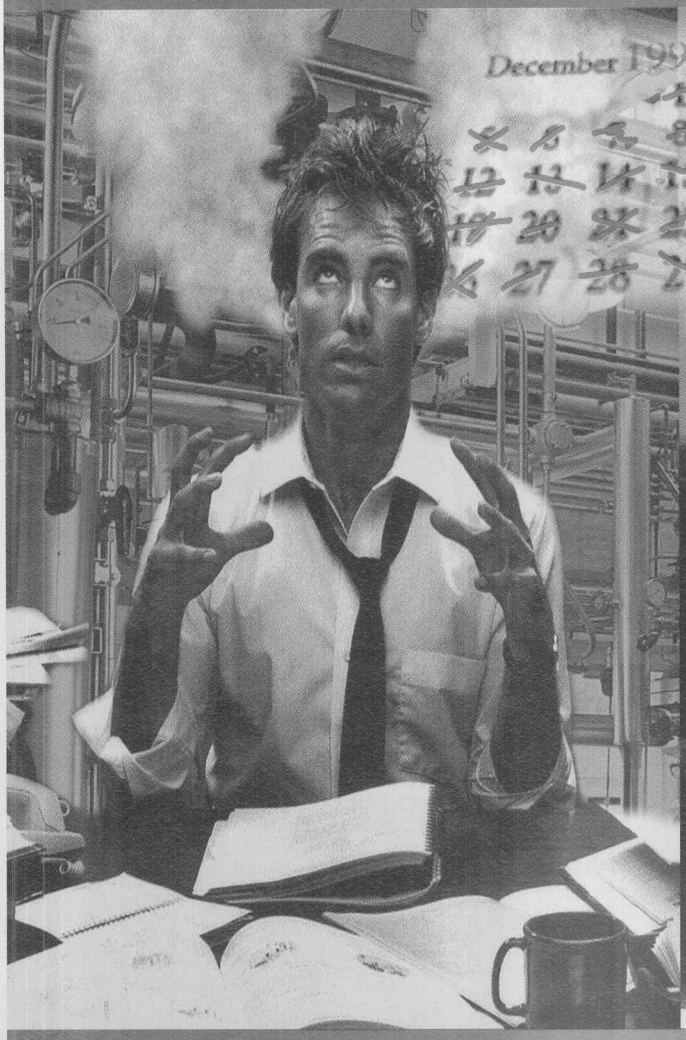
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Where Will You Be When The Year 2000 Arrives?



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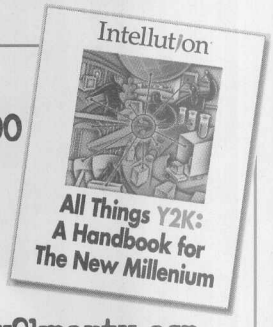


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For information circle 14

FactorySuite 2000 Integrates Modules for Plant Automation

Many "open systems" are less open than they first appear, and this can increase users' integration, maintenance, and upgrade costs.

Wonderware Corp.'s (Irvine, Calif.) new FactorySuite 2000 automation software requires no custom interfaces, has no integration costs, and has components that upgrade simultaneously, say company officials.

Unveiled on Jan. 30, FactorySuite 2000 is a more tightly integrated team of automation software components, all with new feature sets that are expected to provide unprecedented functionality and performance for developing plant-floor automation applications. The 2000 version is Microsoft Windows NT-based, provides a common-install procedure for its integrated application programs, and deploys a real-time relational database for its modules. These application modules in the client/server package apply Microsoft ActiveX for improved ease of use. FactorySuite 2000's application development kit includes all six modules for a U.S. list price of $9,950.

News of FactorySuite 2000's arrival was closely followed by the Feb. 24 announcement that Wonderware has agreed to be acquired by Siebe plc (Windsor, Berkshire, U.K.) for about $375 million (See related coverage in this issue's Up Front section.)

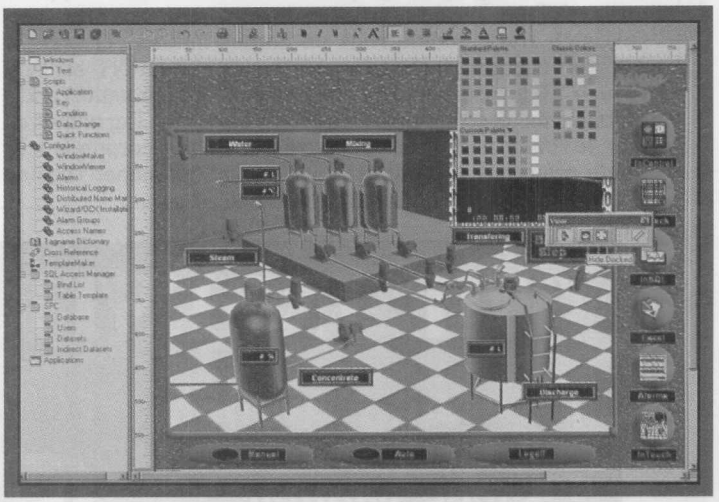
"FactorySuite 2000 is the most important software introduction in the history of industrial automation," claims Roy Slavin, Wonderware's

(continued on p.30)

Siebe plc, Foxboro Parent, to Acquire Wonderware; See Up Front.



Wonderware's InTouch 7.0 is an ActiveX container that serves as the graphical user interface for all FactorySuite 2000 components.



INDUSTRY VIEW

Pacific Scientific Shareholders to Vote on Danaher Offer

Newport Beach, Calif.—Pacific Scientific Co.'s shareholders will vote March 27 on the proposed $460 million acquisition of the company by a wholly owned subsidiary of Danaher Corp. (Washington, D.C.). Shareholders on record as of Feb. 25 will be able to vote at the special meeting, which was called by Pacific Scientific's board of directors on Feb. 17.

According to a merger agreement signed Jan. 31 by the two companies, Danaher's subsidiary would pay Pacific Scientific's investors about $30.25 per share. The offer also includes some Pacific Scientific debts, which would be assumed by Danaher. Besides needing a positive vote from Pacific Scientific's shareholders, Danaher's offer is also subject to federal regulatory approval.

"We're pleased with the combination of Danaher and Pacific Scientific. The businesses Danaher will be acquiring represent attractive strategic opportunities for our process/environmental controls segment," said George Sherman, Danaher's president and ceo.

Lester Hill, Pacific Scientific's chairman and ceo, added that, "I'm very excited that our board and management have fulfilled their promise to deliver full value for shareholders. The global strength of Danaher will allow customers worldwide to enjoy the performance of Pacific Scientific products, while accelerating our improvement process to enhance quality, manufacturing efficiency, and customer service."

Kollmorgen's out

This agreement killed an earlier $23.75-per-share offer from Kollmorgen Corp. (Waltham, Mass.) and cancelled that company's special shareholder meeting scheduled for Feb. 10. Kollmorgen also announced recently that it is withdrawing its recent federal litigation against Pacific Scientific, which had been filed in the U.S. District Court's Central California District.

"Our offer of $23.75 per

(continued on p.46)

NEWS

FactorySuite 2000 integrates module... *(continued from p. 29)*

president and ceo. "It allows plant engineers and management to solve literally any plant floor application problem. And with the unprecedented integration of its application modules in a single powerful real-time relational database, all production data collected on the plant floor are now instantly available to corporate computing applications such as manufacturing or enterprise resource planning (MRP/ERP), scheduling and financial applications.



"A primary feature of the suite is the new 7.0 module of our Wonderware InTouch human-machine interface (HMI) program, which serves as the common GUI [graphical user interface] and client visualization portion of the FactorySuite. It includes an application explorer to enhance navigation among the integrated suite components and it functions as an ActiveX container, so users can also drop any third-party ActiveX objects into any FactorySuite application window for plug-and-play extension of the suite's application capabilities."

InTouch HMI module runs on both Windows NT and 95, while the runtime application can be run as an NT service. InTouch 7.0 provides support for up to 60,000 tag names and a new tag name browser provides easier handling. Tag names on other InTouch nodes can be browsed, then incorporated by remote reference without creating a local tag name. Tags on InControl and InBatch nodes can be browsed and used as well.

The suite includes a family of I/O Server interfaces for connecting to plant-floor devices, including the new fieldbus protocols. All data are time and quality stamped. A new SuiteLink protocol provides peer-to-peer communications among FactorySuite components, and between clients and I/O servers. FactorySuite is also an OPC client, which allows access to added devices.

In addition, Wonderware's IndustrialSQL Server real-time relational database works as the primary data management tool for the suite's modules. It allows users to capture thousands of real-time plant floor data points simultaneously; provides mix-and-match of real-time and historical data for relating events to time-based data; adds event properties; and simplifies installation and configuration procedures.

FactorySuite 2000's other enhancements of the original suite's application components include:

- InControl, a module that has new interfaces to many more types of devices. It also now contains fuzzy logic objects and new ActiveX controls for motion-control applications. Using DCOM, it provides distributed control capabilities;
- InTrack WIP tracking module, which has ActiveX objects to build custom dialogs rather than just use predefined dialog boxes. It also provides enhanced scrap tracking and control features and new user control over inventory consumption rates;
- InBatch flexible batch management module, which incorp-

(continued on p. 32)

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For information circle 17

orates enhanced recipe development tools as well as ActiveX controls for access to batch execution information and sequencing. It now offers signature authority capabilities to meet new system functionality authorized by the U.S. Food and Drug Administration; and

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For more information, Circle 350 or visit www.controleng.com/info.

NEW IN CONTROL

Intellution and Grayhill Agree to Integrate Products

Norwood, Mass.—To help users cut time spent on I/O device configuring and tag naming, Intellution Inc. and Grayhill Inc. (LaGrange, Ill.) recently agreed to port Intellution's Paradym-31 SoftLogic control software to Grayhill's PC-based OpenLine controller [Both are winners of *Control Engineering*'s 1997 Editors Choice Awards.] The Paradym-31-enabled controller will take advantage of Intellution's FastLink technology to share I/O data with Intellution's FIX human-machine interface.

Contrary to most applications where I/O configuration and tag name assignments are time consuming, the OpenLine controller scans the ID pins of each I/O point populating the Paradym-31 database automatically. This database automatically populates the FIX database using FastLink over an Ethernet network.

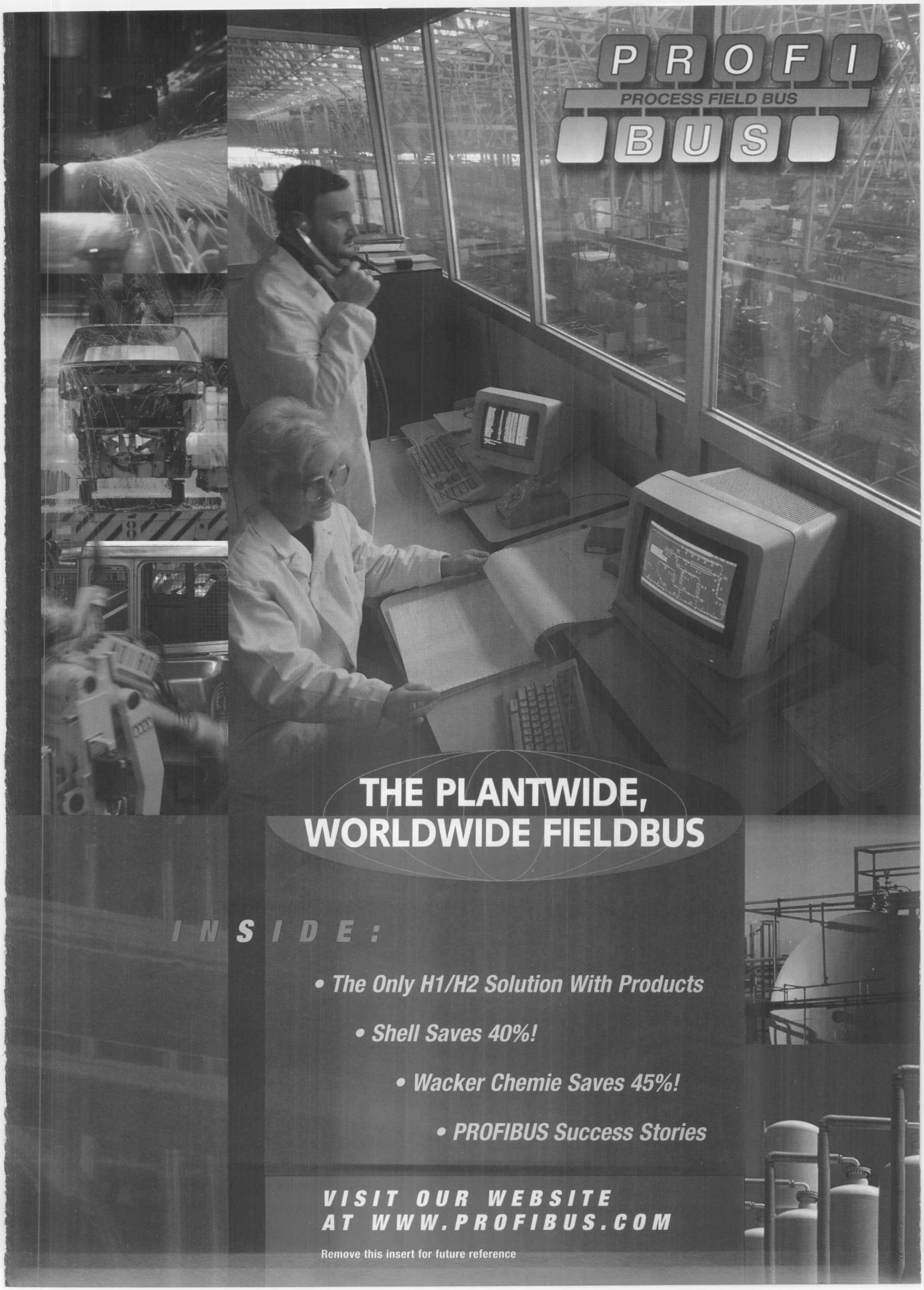
Christopher Zei, Intellution's director of marketing and business development, says, "The partnership with Grayhill is the tightest integration of Intellution software products and third-party hardware possible and presents a very competitive and capable overall solution."

Grayhill expects to be in beta testing in May and release products this summer.

"Simplicity is highly valued by our customers," added Brian May, president of Grayhill's Electronic Systems division. "I believe the integration of the FIX, Paradym-31, and OpenLine will result in the simplest system to configure, program, and troubleshoot on the market today."

For more information, Circle 351 for Intellution or Circle 352 for Grayhill or visit www.controleng.com/info.

(continued on p. 42)


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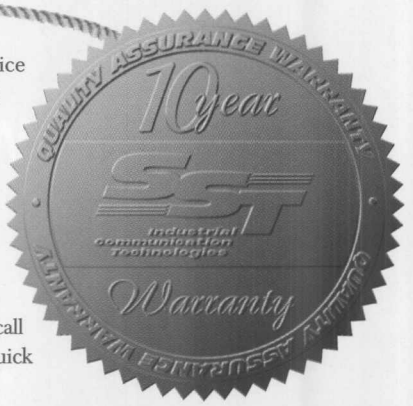
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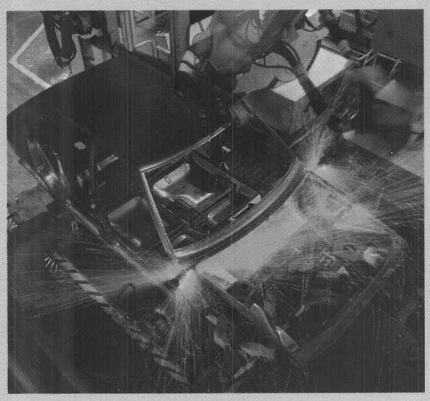
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Dozens of new process projects will install PROFIBUS-PA during 1998. Numerous installations are featured in this insert. Currently, more than $10 million dollars of PROFIBUS-PA instrumentation and control systems are installed and in use at chemical, brewing and petroleum plants worldwide, all of them real installations, NOT field trials.



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PROFIBUS Success Stories:

Cadiou Electro-Industrie (CEI)

This company in Landerneau, France has just completed the commissioning of a new plant for food additives supplier Danisco Ingredients using H1 PROFIBUS-PA as the process fieldbus linked to an H2 PROFIBUS-DP network for control. The plant produces alginates, which are used extensively by the food and pharmaceuticals industries. Siemens and Endress+Hauser equipment was used. The benefits of using PROFIBUS included simpler installation, better economics, centralized configuration and modularity.

Polymer Latex

This new styrene storage plant in the UK is using eight PROFIBUS-PA measurement points, including pressure, hydrostatic level and temperature measurement devices from Endress+Hauser.

(Continued on page 6)

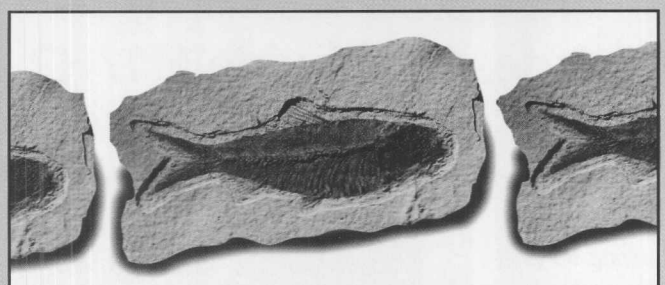
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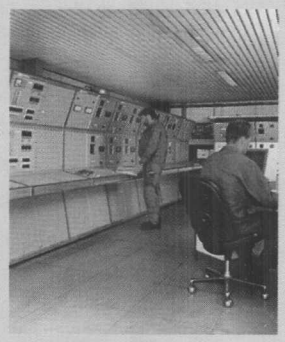


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Shell saves 40% on Installation Costs.



The Shell Oil Lubrication Plant in Hamburg, Germany, which produces over 350,000 tons of oil products annually, is one of the largest Shell plants of its type worldwide. Shell has been a PROFIBUS user for many years. Now, in a major oil blending plant retrofit, more than 7000 instruments and sensors are being networked. As a direct result of using PROFIBUS-DP, PROFIBUS-PA and AS-Interface, Shell is realizing savings in installation costs of roughly 40% by eliminating excess wiring and connection components and making 'right first time' connections the norm. Commissioning is also much faster, because all set-up and testing can be carried out from a single control room console.



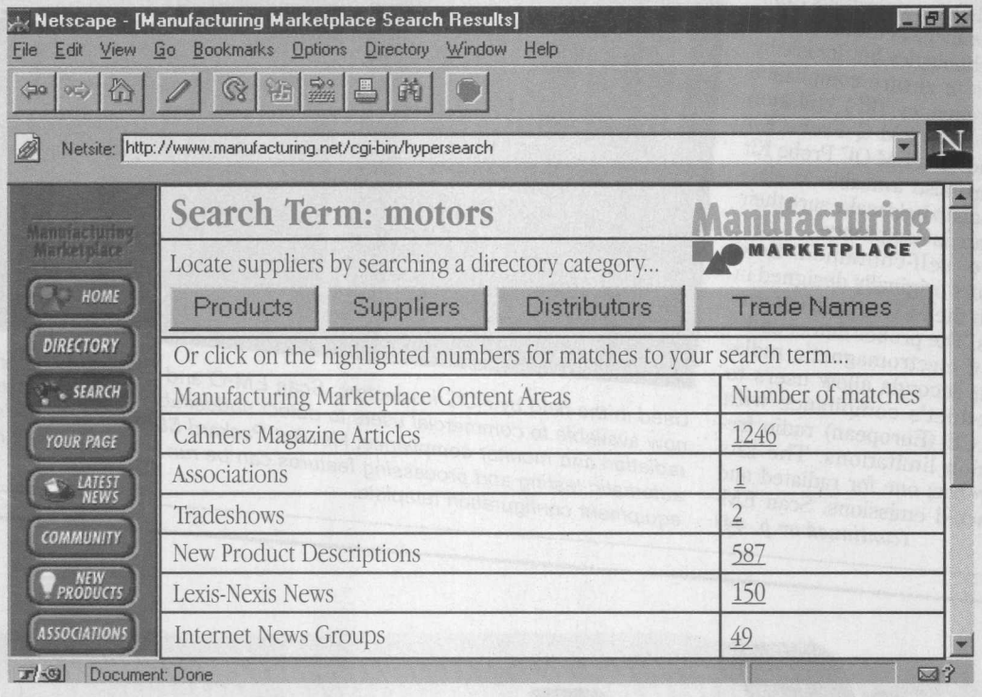
Supervised by a Honeywell SCAN 3000 Control System running Total Plant Batch software, the plant spans an area of approximately 0.4 square miles and includes 150 tanks of up to 700 cubic meters. About 60 base oils are used and over 200 additives, and 630 different oil types are produced. PROFIBUS networks connected to Siemens PLCs provide local control of blending operations under the direction of the SCAN 3000 system. More than 500 analog measurements are involved (level and temperature), and these are connected using H1 PROFIBUS-PA networks linked by segment couplers to H2 PROFIBUS-DP. Ninety percent of the plant signals, including level switches and over 2000 on-off valves, are connected via AS-Interface into the PROFIBUS-DP network using standard gateways. One noticeable result of the re-vamp, according to Contractor, Peter Jacob, is the complete lack of I/O hardware, since all devices are multi-dropped on two-wire cables.



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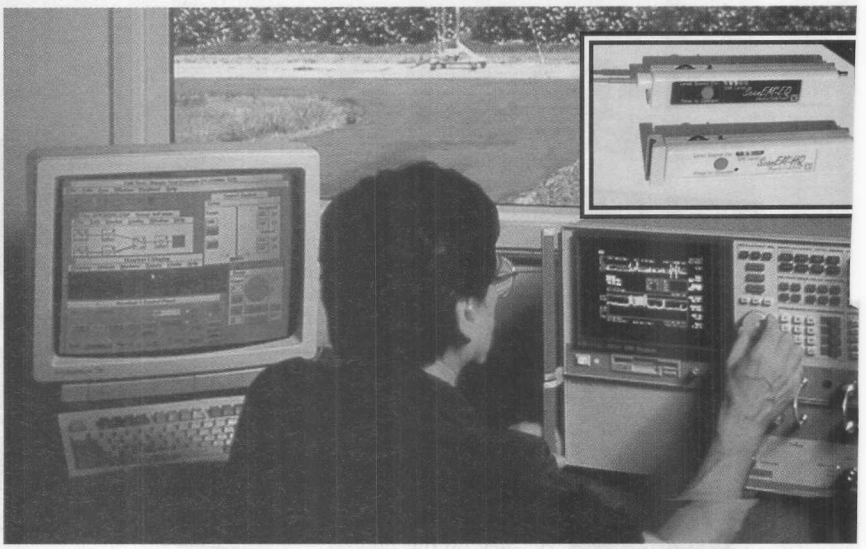
Probe Kit, Testing Software Aid EMI Testing

Santa Cruz, Palo Alto, Calif.—Two recent innovations from the Golden State may help users in the electromagnetic interference (EMI) testing and compliance fields.

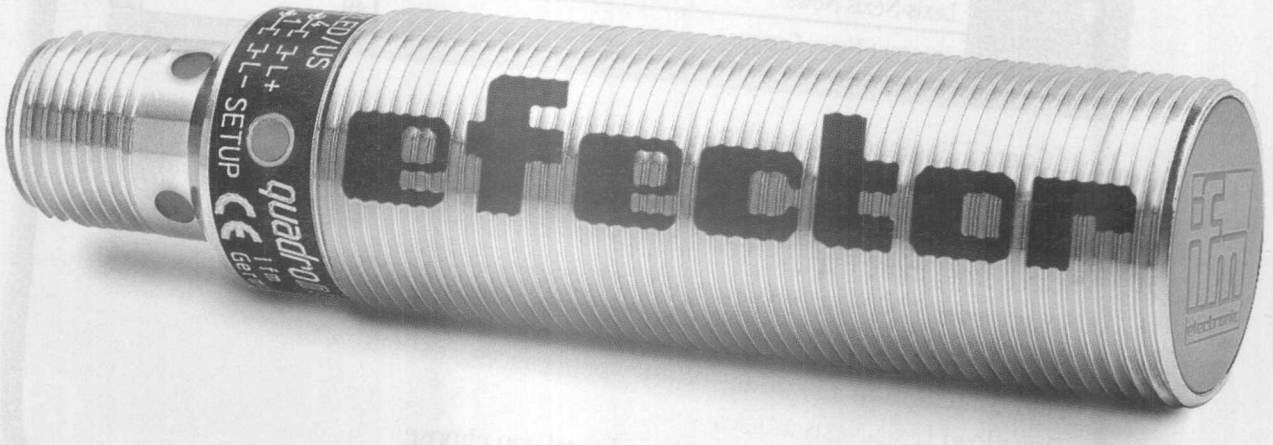
First, the Federal Communications Commission (FCC) recently picked EMI probes from Credence Technologies Inc. for use by its field inspectors to ensure compliance with FCC radio frequency (RF) emission regulations. The Scan EM-Q Probe Kit Model CTK017 and Scan EM-QC Probe Kit Model CTK019 are also available to electronics professionals to help make sure their production units are in compliance.

The kits are self-contained field strength indicators originally designed in cooperation with the FCC to help enforce its p.15 RF rules. The probes detect undesirable levels of electromagnetic radiation and within seconds allow users to evaluate a product's compliance with FCC p.15 and CE (European) radio frequency emission limitations. The kits contain two probes: one for radiated and one for conducted emissions. Scan EM-

(continued on p. 44)



Used in the field by FCC inspectors, Scan EM-Q and Scan EM-QC probe kits are now available to commercial users to detect undesirable levels of electromagnetic radiation and monitor compliance. Hewlett-Packard 58576B software's automatic testing and processing features can be run from one easily-modified equipment configuration template.



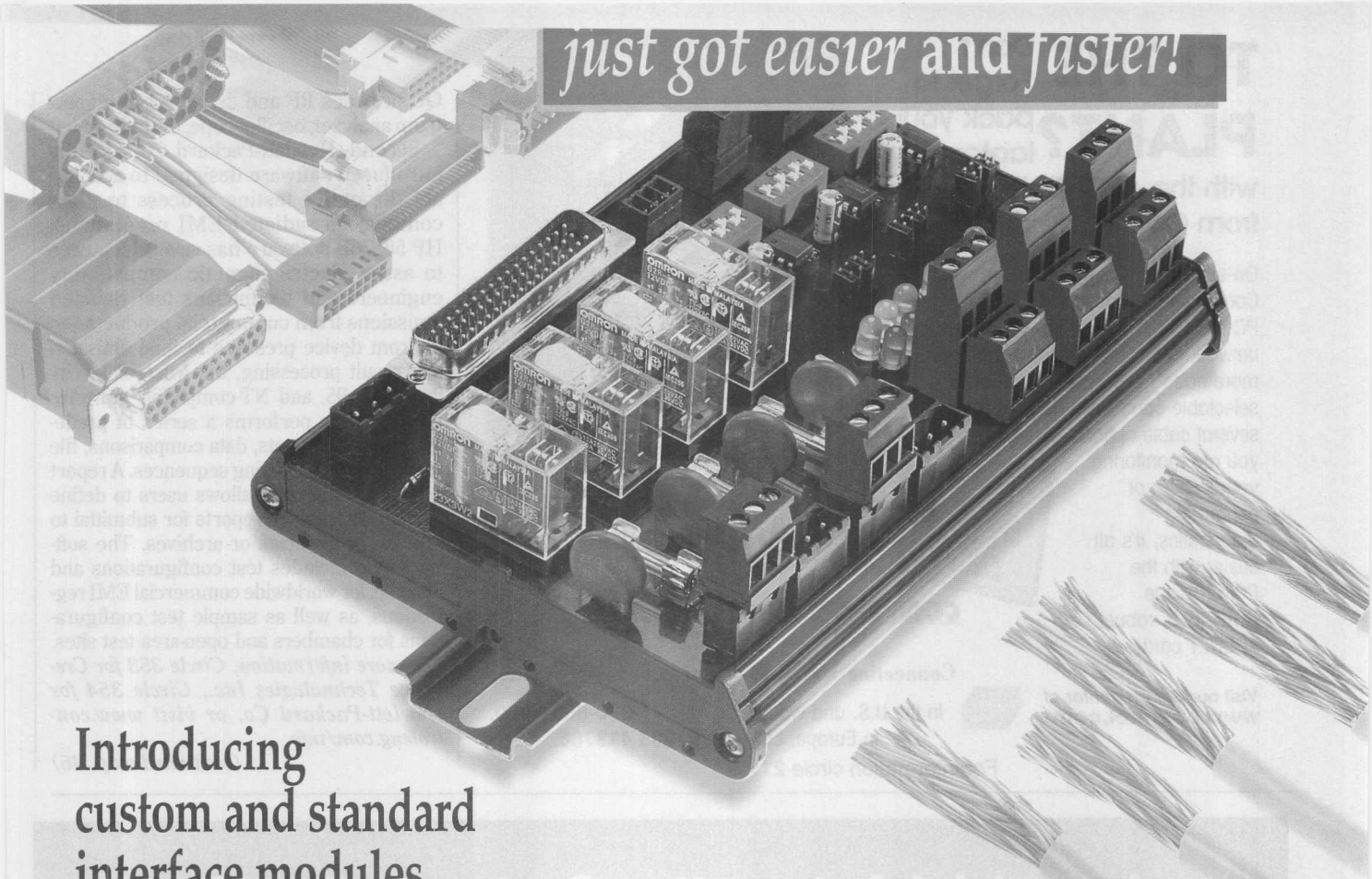
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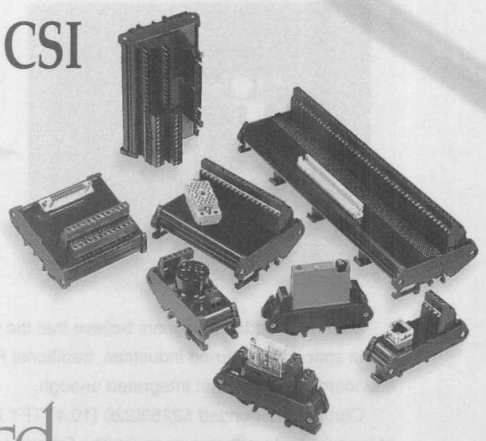
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CONTROL ENGINEERING NEWS

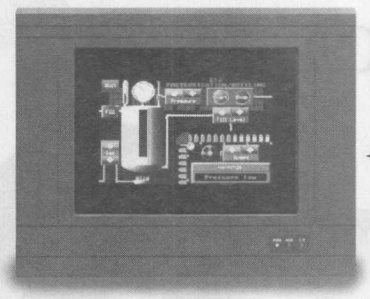
QC provides RF and dc output to a spectrum analyzer, oscilloscope, or multimeter.

Second, Hewlett-Packard Co. recently introduced software designed to accelerate the entire testing process to meet commercial radiated EMI regulations. HP 58576B software has several features to assist electromagnetic compatibility engineers and technicians test radiated emissions from commercial products.

From device prescans to final emission test result processing, the Microsoft Windows 3.1, 95, and NT-compatible software automatically performs a series of predefined measurements, data comparisons, file transfers, and reporting sequences. A report generation interface allows users to define custom compliance reports for submittal to regulatory agencies or archives. The software also includes test configurations and libraries for worldwide commercial EMI regulations, as well as sample test configurations for chambers and open-area test sites. *For more information, Circle 353 for Credence Technologies Inc., Circle 354 for Hewlett-Packard Co. or visit www.controleng.com/info.*

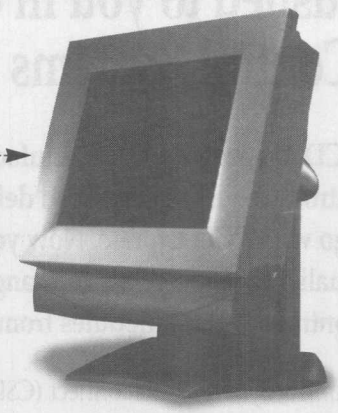
(continued on p. 46)

Industrial Automation System In One Box



Super Slim Panel PC
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All-in-One 12.1" TFT Plastic-Housing
Panel PC Model : 5227 / 5228



Many embedded designers believe that the Panel PC is the next wave of the embedded system. For some spaced-concerned industries, traditional PCs with a separate main system, display monitor and keyboard are simply not integrated enough.

Chroma announced 5225/5226 (10.4" TFT LCD) and 5227/5228 (12.1" TFT LCD) flat panel PCs series, all series include complete I/O ports (4 x serial ports with power capability, Ethernet, 4 channel DIO, KB, Mouse) connecting many peripherals (such as touchscreen, cursor pointers, barcode scanner and counters) and packs special industrial features like watchdog timer, CMOS double backup, all in a single system. The full PC functionality coupled with its industrial-grade construction makes the system easily tailored to any embedded applications and allows the system to endure the continuous operation in any hostile industrial environments where stability and reliability is a must.

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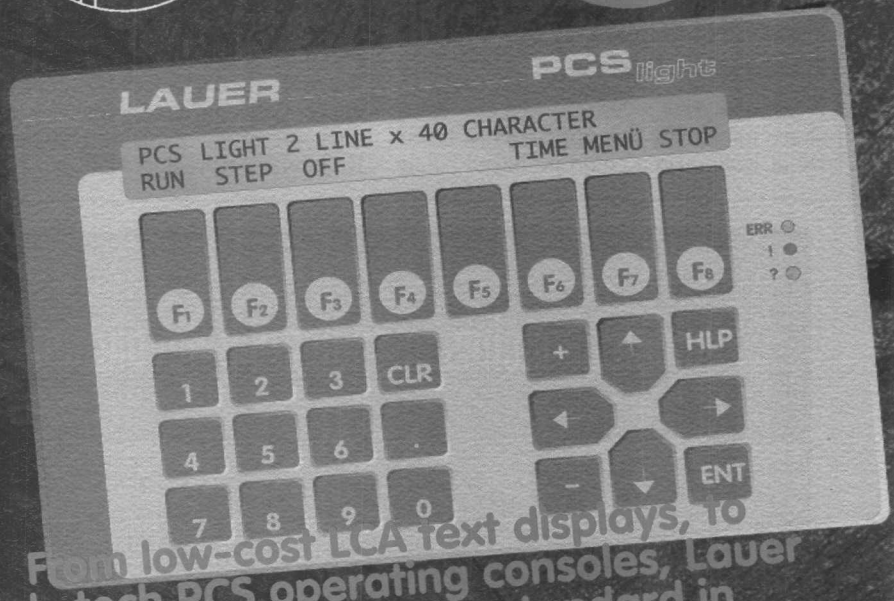
For information circle **22**

EUCHNER

LAUER

SETTING A NEW STANDARD

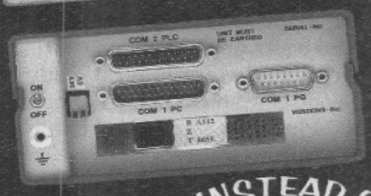




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PCS Topline operating consoles offer peak performance with outstanding functions, unique ergonomics and exquisite design. PCS offers simple operating procedures and limitless setup options to help you keep everything under control. PCS is an economic must for every automation professional. The operator is informed in a simple manner, regardless of the connected PLC.

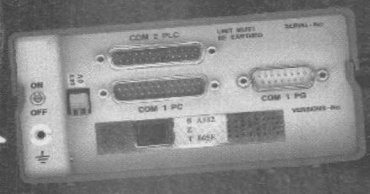




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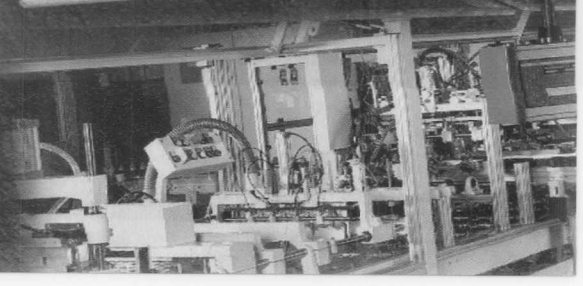
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For information circle **23**

INDUSTRY VIEW

Pacific Scientific Shareholders...

(continued from p.29)
share for Pacific Scientific was as far as we at Kollmorgen could go based solely on public information. Despite our repeated requests, Pacific Scientific declined to give us access to confidential information that might have warranted a higher offer. Accordingly, we have determined that the appropriate course of action was to terminate our offer," explains Gideon Argov, Kollmorgen's president and ceo. "The valuation accorded Pacific Scientific by Danaher clearly validates our strategy of focusing on the high performance electronic motion control market. Our objective remains to be the leading company in this field on a worldwide basis, and we will continue to build Kollmorgen toward that end, customer by customer and product by product."



New Belden® Industrial Cable Takes Data Where It's Never Gone Before.

Corrosive chemicals. Damaging moisture. Temperature extremes. They've made process industries like oil, gas, and petrochemical; chemical; pharmaceutical; mining; power generation; wastewater treatment; pulp and paper; and food processing "off limits" to traditional data cables.

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For information circle **24**

Process Control Technologies Lead PaperWeek Show Attractions

Montreal, Quebec, Canada—In the dead of winter, Canada's lumber industry comes to an icy halt. With downtime pending, the Canadian Pulp & Paper Association held its PaperWeek International conference here during the last week of January. Despite ice storms, the 1998 event drew more than 15,000 pulp and paper industry attendees from 40 countries.

An important part of PaperWeek was EXFOR '98, which featured 457 exhibitors displaying the latest technologies devoted to pulp and paper product manufacturing. Well-represented were several leading process control system suppliers, including ABB, Fisher-Rosemount, Foxboro, and Honeywell-Measurex.

New from ABB is the AccuRay HyperScan fullsheet imaging system. With HyperScan, papermakers see 100% of their sheet, as opposed to the 1% visibility provided with conventional mechanical scanners and sensors. The 100% visibility improves product uniformity through fullsheet controls and runnability through advanced process diagnostics. HyperScan, with frame foundation, light source, and cameras, is integrated with the AccuRay 1190 system for display, analysis, and control.

Also on display in the ABB booth was the ACS 1000 medium-voltage induction motor drive for general-purpose use. This is the first drive to use ABB's new Integrated Gate Commutated Thyristor (IGCT), which provides high-speed switching, high-voltage blocking, and low-loss conduction. (For more on IGCT, see the Editors' Choice cover article in this issue; also see *CE*, July 1997, p. 17; and December 1997, p. 9.).

Go with the flow

Flow measurement was hot in Fisher-Rosemount's booth. On display were the

(continued on p. 51)



UNLEASH THE PRODUCTIVITY

For information circle **25**



SUITE F

Meet The World's First Integrated MMI System.

Introducing Wonderware® FactorySuite™2000. This integrated Manufacturing Management Information (MMI) System is an outrageous team of components.

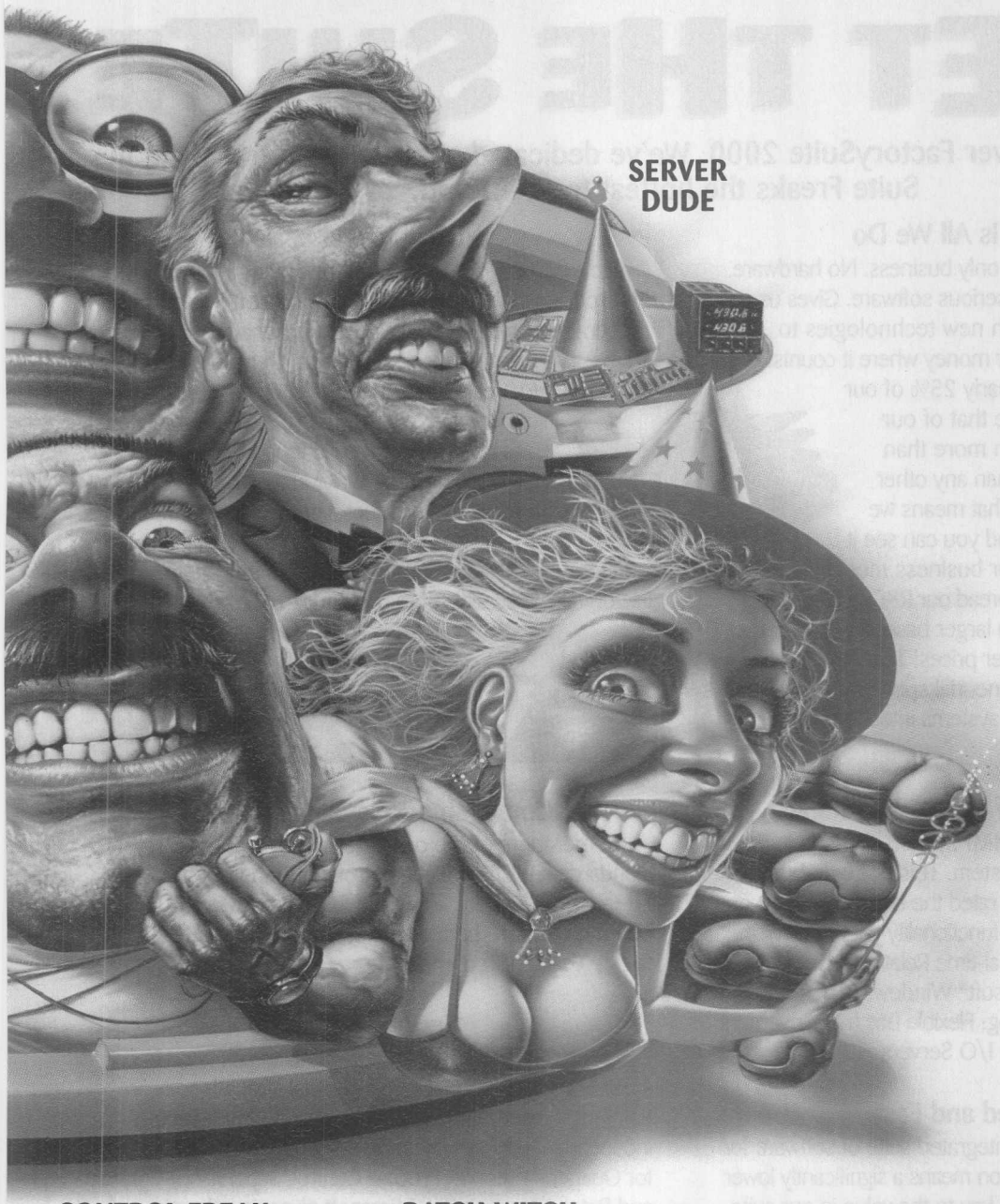
Factory Four-Eyes (InTouch), the team leader, touches and visualizes everything in the plant. Displays it all brilliantly.

Control Freak (InControl™) controls factory equipment,so that everything marches to the right beat. Does it all in record time.

Data Junkie (IndustrialSQL Server™) is totally addicted to manufacturing data–just eats it up. Even deals it to the suits upstairs.

Tracker (InTrack™) gets the production facts on the factory floor–what happened, when it happened, how long it took and who was involved. Keeps all the data straight.

Batch Witch (InBatch™) can conjure up new recipes and change processes in a plant with a wave of her wand. Magically saves time and money.



REAKS

Scoutie (Scout™) jets about on the Internet, so no matter where you go, you can watch what's happening in your factory. Loves to browse around.

Server Dude (I/O Servers) has over 600 ways to ensure that everything on your factory floor is properly connected. Always serves you impeccably.

What an integrated team! Put them to work in your factory and increase your productivity and profitability.

FactorySuite™ Wonderware® 2000

For information circle **26**

MEET THE SUITE

You'll freak out over FactorySuite 2000. We've dedicated our business to making the Suite Freaks the hottest team around.

Software Is All We Do

Software is Wonderware's only business. No hardware. No integration services. Just serious software. Gives us the ability to focus on which new technologies to embrace or avoid. We put our money where it counts. Our investment in R&D is nearly 25% of our revenues–more than double that of our nearest competitor. We're in more than 75,000 sites worldwide–more than any other industrial software supplier! That means we get tons of customer input and you can see it reflected in the product! Our business model is based on volume sales. We spread our R&D, testing and marketing expenses across a larger base. So, you get higher quality software at lower prices! This model also lets us leverage the entrepreneurial spirit and expertise of professionals dedicated to systems integration, sales and vertical markets.



Extensible and Scalable

FactorySuite is an industrial operating platform that incorporates the benefits of the Microsoft Windows NT operating system. FactorySuite's functionality easily extends to meet your specific needs. Our toolkits allow you to create the extensions yourself or customize solutions for your aftermarket. Our volume model allows us to attract excellent partnerships. FactorySuite users can take advantage of more than 600 third party product extensions. Or, tap into domain-specific expertise through our certified Systems Integrators. And, you choose the size of system. FactorySuite is scalable from one node to as many as you need.



Best of the Best

FactorySuite 2000 is an MMI System–Manufacturing Management Information System. This hot little bundle delivers components that are rated the best of the best on their own.* You get all the core functionality you need for the factory floor: Visualization; Real-time Relational Database; Pure Control based on Microsoft® Windows NT;® Remote Visualization; Resource Tracking; Flexible Batch Management and access to more than 600 I/O Servers.

Integrated and Easy

It's the first and only fully integrated suite of software for the factory floor. Total integration means a significantly lower cost of ownership to you–the key to the value in our suite. When we upgrade the FactorySuite, each component is upgraded, integrated and tested together. Ever tried to use multiple packages of software, from more than one vendor? Talk about risky business! Total integration allows you to leverage your investments in training and system compatibility. Each Suite Freak is as easy to use in its niche as our legendary InTouch is in the HMI market.

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As members of the organizations that set industry standards–OPC Foundation, Profibus Trade Organization, Interbus S Club–we know the Suite Freaks are 100% compatible with them all. And, FactorySuite 2000 is totally Year 2000 compliant.

Serious Software

FactorySuite 2000–all the functionality you need in one small box for one price. True industrial strength software. Fully integrated. Find out for yourself why a recent independent user survey* rated Wonderware #1 in software for Operator Interface, Process Control, Supervisory Control and Batch Management. Microsoft gives us a thumbs up.* AMR and ARC applaud us.* Our focus on software pays off for you the customer. OK, maybe we are an outrageous company with a funny name, but we're extremely serious about creating great software. Let our Suite Freaks make you more productive. Get in our faces at www.wonderware.com, e-mail us at FS14@Wonderware.com or meet the suite at 714-727-3200.



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©1998 Wonderware Corporation. All rights reserved. Wonderware is a registered trademark of Wonderware Corporation. Wonderware FactorySuite, InControl, IndustrialSQL Server, InTrack, InBatch and Scout are trademarks of Wonderware Corporation.All other trademarks are the property of their respective owners. *For specific references, go to our internet site.

For information circle **27**

Mass ProBar, which combines Rosemount's Model 3095 MV mass flow transmitter with Dieterich Standard's Annubar, and the Model 8800A smart vortex flowmeter.

Mass ProBar measures four process variables in one device; DP, static pressure, temperature, and mass flow. Mass flow rate accuracy is within 1.3% for liquids, gases, and steam over an 8:1 flow turndown. New electronics in the 8800A provide accessible test points to aid in ISO 9000 electronics verifications and troubleshooting.

During a special presentation at the Chairman's Welcoming Reception, Foxboro was recognized for its long participation in EXFOR. In its booth, Foxboro showcased products in three main categories, including advanced control solutions, integrated information technology solutions, and intelligent field instrumentation.

Open control solutions included direct interface between a third-party scanning gage and Foxboro's I/A Series system to enable machine direction and cross-direction strategies. For integrated IT, Foxboro teamed with Documentum to embed the company's Enterprise Document Management system within Foxboro's I/A system to create FoxEDM.

Under pressure

Field and analytical instruments were highlighted in the Honeywell-Measurex booth at EXFOR '98. The company previewed its gage pressure, flush-mount pressure transmitter, STG93P, for applications where process clogging is a concern. Replacing three transmitters with one is Honeywell's SMV3000 smart multivariable transmitter, which provides compensated mass flow measurement of air, gas, and steam. Of special note to the pulp and paper industry was the MagneW3000 Plus, a pulsed dc electromagnetic flowmeter.

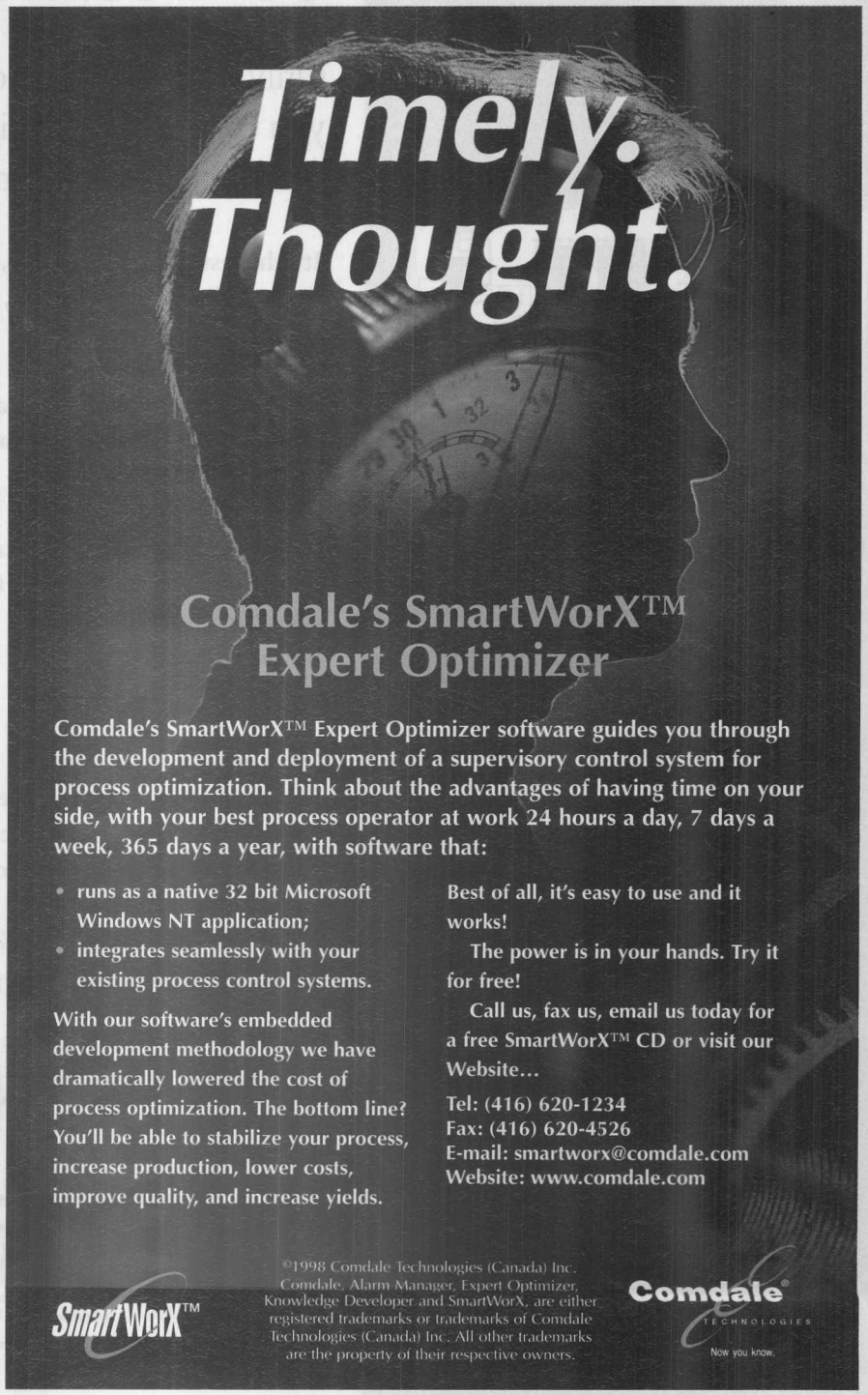
Also of special interest to industry professionals was Honeywell-Measurex's new FAST (fullweb advanced systems technology) Web Imaging system. FAST uses digital CCD line-scan cameras to produce photo-like images of defects and the surrounding area. The new system is said to be faster and offer enhanced analysis and networked processing of visual quality information.

ARC Forum Mulls Automation's Future

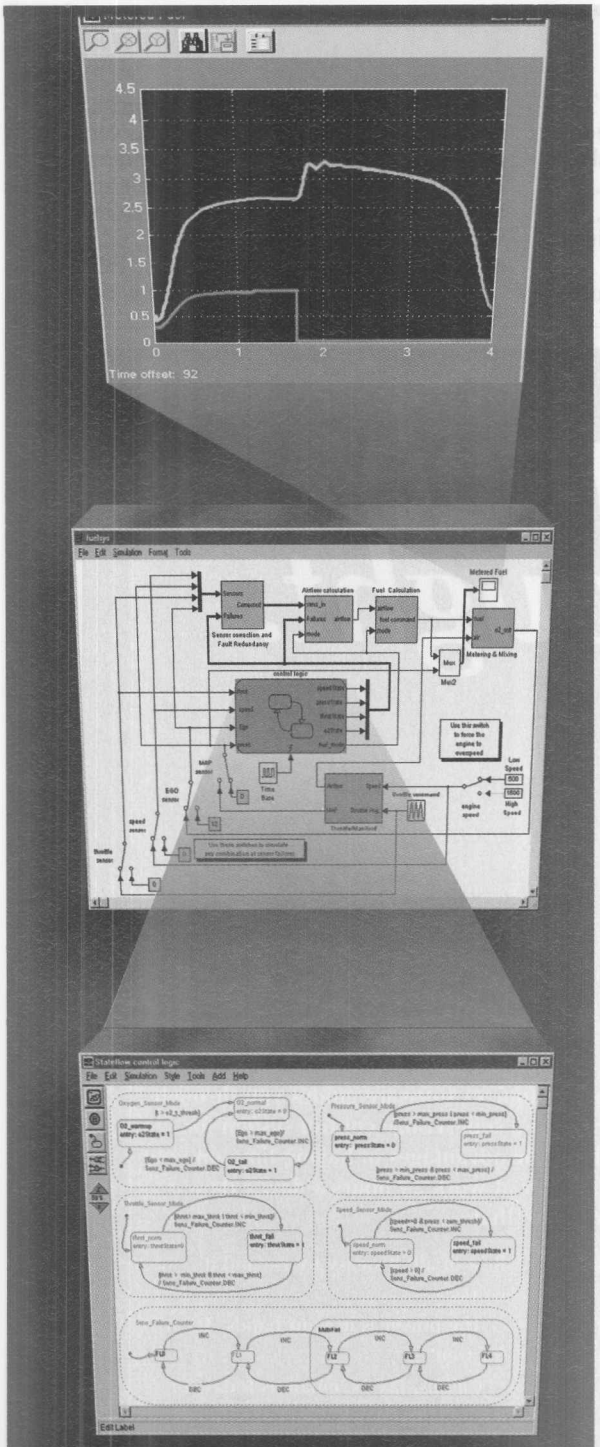
Orlando, Fla.—The future of automation will be on the World Wide Web, according to most speakers at Automation Technologies Forum '98 sponsored by Automation Research Corp. (Dedham, Mass.). The conference on Feb. 9-10 brought together manufacturers, integrators, and automation users to discuss future trends.

The speakers project that controls engineers will write hypertext markup language (HTML) pages for web servers and web clients on Microsoft Windows NT platforms. Users will experience many benefits from object programing using compoenet object model (COM) and OLE for Process Control (OPC).

(continued on p. 53)



For information circle 28



Fault-tolerant fuel injection system

The Simulink diagram (center) models the controller with airflow and fuel mixing. The Stateflow diagram (bottom) shows logic for detecting and responding to sensor failures. The scope (top) shows both a continuous signal and a discrete-event signal, showing the response of the fuel rate to the sensor failure.

one tantalizing step closer to reality.

Only new Stateflow together with Simulink lets you combine dynamic and event-driven simulation in the same development environment.

It's the faster, more intuitive, more realistic way to design, simulate and prototype.

Designers of automotive, aerospace, telecommunications and other embedded systems now have a way to perform faster, more accurate and far more complete simulations of complex, large-scale systems. Which means it is now far easier to optimize product performance while dramatically accelerating time to market.

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CONTROL ENGINEERING PRODUCT RECOGNITION AWARD

They add that Java will be a valid programming tool in the specific NT environment, as well as for device-independent programs. In fact, the OPC Foundation is working on a paper that will establish a method for writing Java applets for OPC.

Vendors are developing these technologies for engineers who want open systems—the ability to build systems from commercially available components. However, while open systems provide more flexibility and competition, they frequently lack a single point of responsibility. As one engineer asked a panel at the forum, "Who will support me when the process goes down?" The answer is that users must choose vendors carefully before buying, and make sure vendors have experience in the industry, have tested products, and have good partner relations with suppliers.

The forum's speakers also agreed the network of the future will clearly be Ethernet-based. Although various device-level networks will continue for a while, Ethernet will be the primary control and information network. They added that this "future" already exists in many manufacturing sites.

Likewise, more data will be sent and presented in the future using Internet technology. Devices will have embedded Java or Microsoft WindowsCE applications and will also be web servers. Internet browsers, such as Netscape Navigator, Microsoft Internet Explorer, or custom-written engines will fuel moves to human-machine interfaces. "Push" technology, developing now for the Internet, will be used to send alarm e-mail to appropriate monitors and computers.

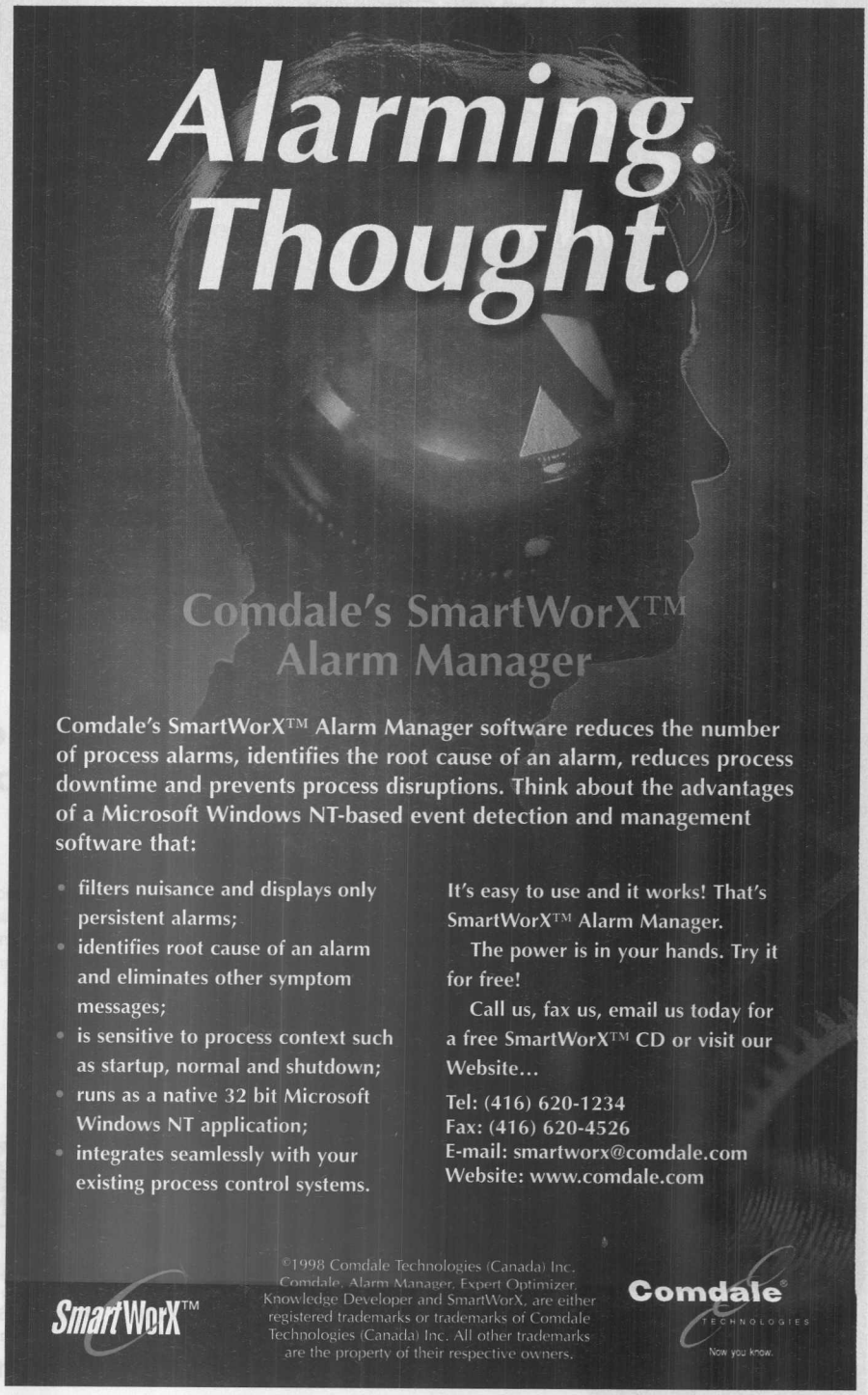
Andy Chatha, ARC's president, noted in his kick-off address that technologies from information technology (IT) departments are finding their way to the factory. In many cases, control engineers will be working with IT personnel more often. Mr. Chatha added that engineers should "train" IT people in the specific needs of machine and process control and find ways to work with them.

Robotics Council Sees Progress

Washington—To help spark a national initiative to nurture robotics and intelligent machine technologies, five U.S. senators and one U.S. representative recently cosigned a letter asking senior government officials to draft a memorandum on the subject. The U.S. Departments of Defense, Commerce, and Energy along with NASA and the National Science Foundation will appoint officials to write a paper on how the departments can work together to promote these technologies.

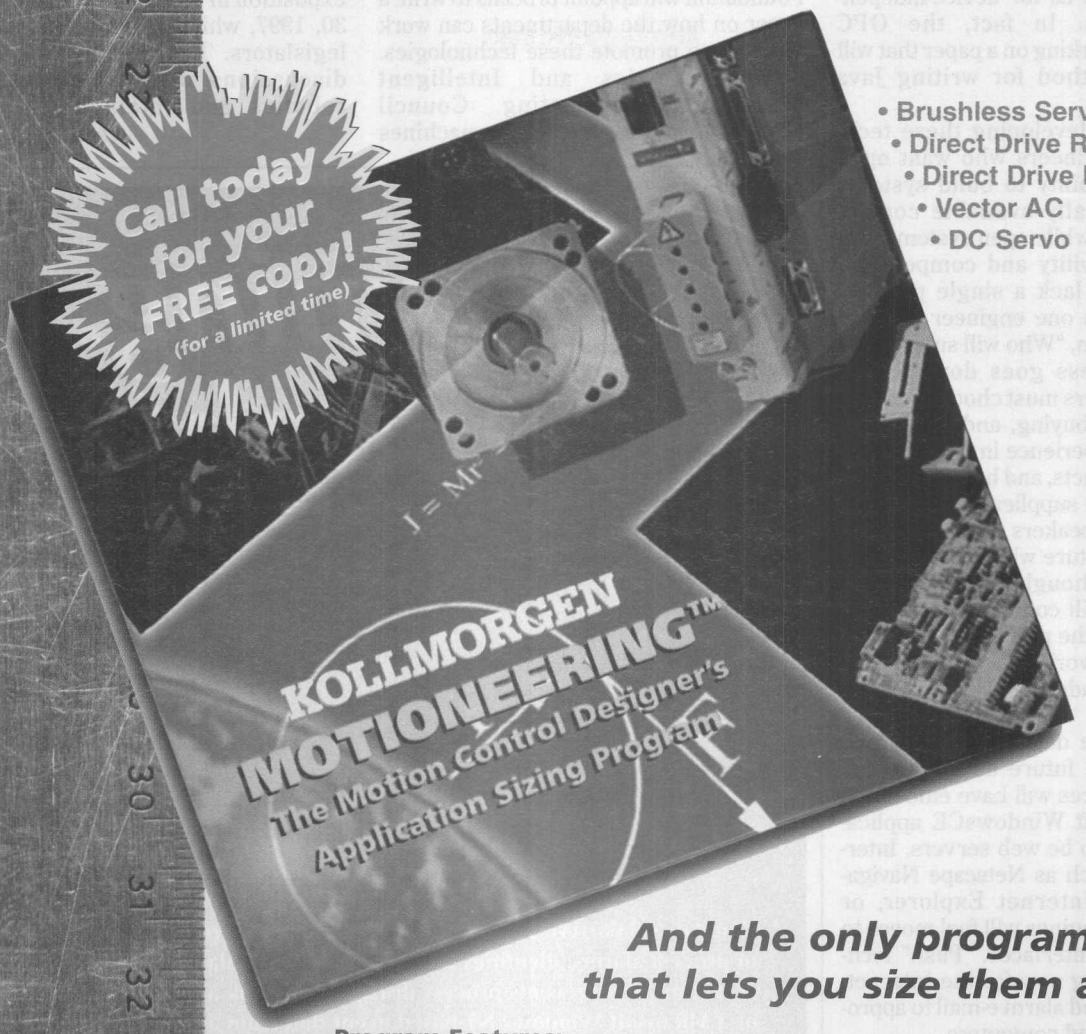
The Robotics and Intelligent Machines Coordinating Council (RIMCC) says the intelligent machines industry is poised for a greater emergence. RIMCC held a congressional exposition in Washington, D.C., on Sept. 30, 1997, which was attended by many legislators. The event included panel discussions on the importance of robotics and intelligent machines

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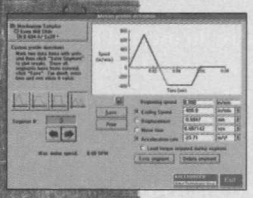
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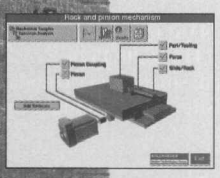
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For information circle **31**

to national security, the future world economy, and the health and safety of workers.

Dr. Patrick Eicker, RIMCC's head and director of the R&D Lab at Sandia National Laboratory (Albuquerque, N.M.), says the legislators' letter is the next logical step needed to encourage the robotics and intelligent machines fields. He added that RIMCC will continue to work with these agencies and Congress in developing national initiatives to encourage these industries.

North America, Asia Lead AC Drive Surge

Dedham, Mass.—AC drive business worldwide continues to expand rapidly, driven by a burgeoning North American market and ongoing expansion in Asia, according to the new *AC Drive Worldwide Outlook* by Automation Research Corp. (ARC). The combined markets of Europe, the Middle East and Africa (EMA) remain the largest regional segment, followed by Japan and North America.

ARC's report projects that North America will continue to expand at near double-digit annual percentage rates over the next five years. Likewise, despite Asia's recent economic crisis, regions such as China and India can also expect strong growth as new ac drive technology and continued price erosion inspires potential users.

By geographic region, the report found that current segments–in percent of dollars–of the worldwide ac drive market include: EMA (38.4%), Japan (27.3%), North America (21.3%), rest of Asia (11.6%), and Latin America (1.4%).

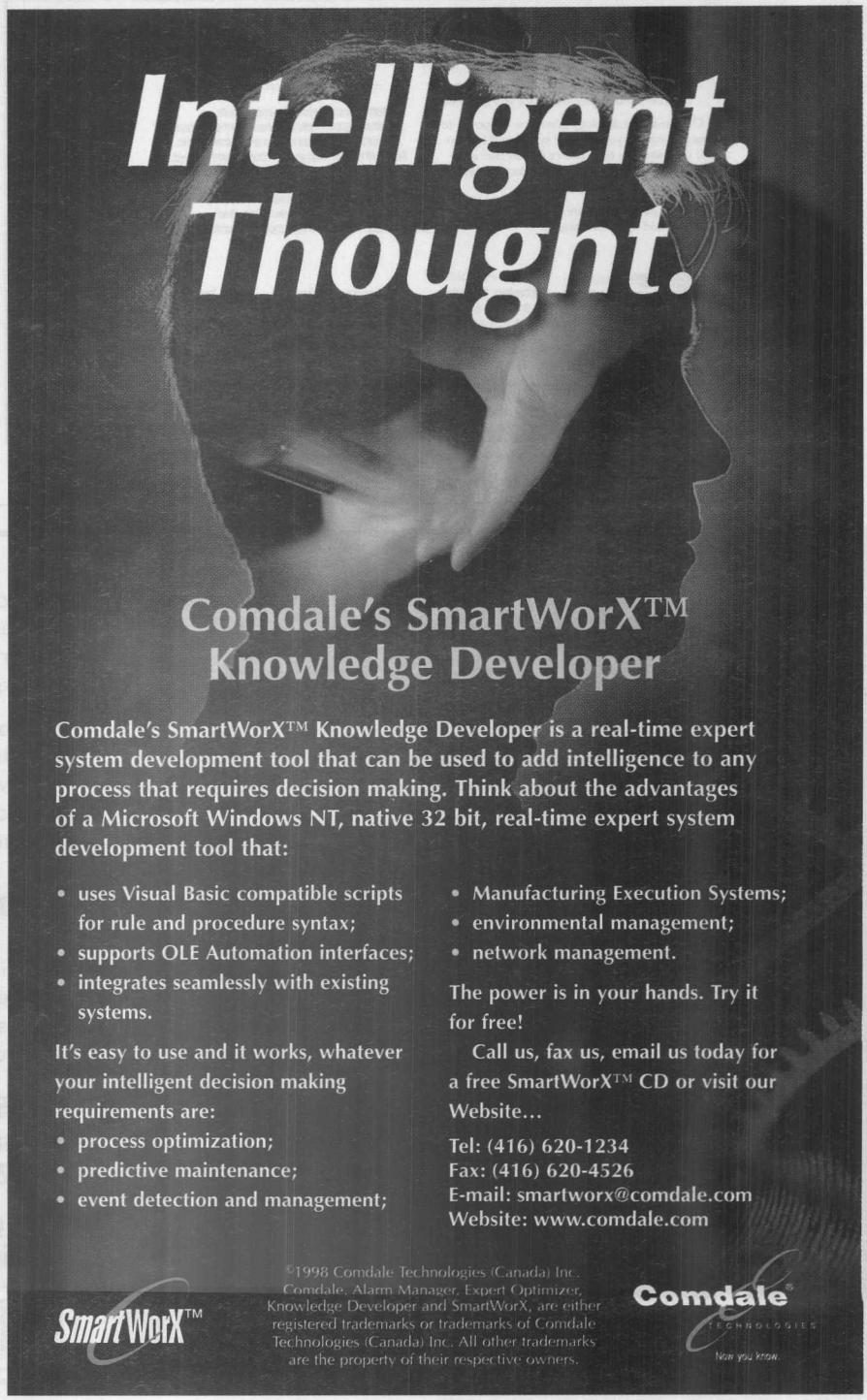
Interestingly, although the worldwide ac drive market still has many different facets and niches, ARC's report adds that it is increasingly coalescing into one global market. North America, Europe, and Asia can no longer be considered independent entities in which the leading suppliers expect competition from only domestic competitors. Consequently, major ac drive suppliers are seeking to become strong in all regions to thrive over the long term. They are forming more domestic and international strategic partnerships.

For more information, Circle 355 or visit www.controleng.com/info.

Contract Manufacturing, New Components Drive Surface Mount Market

Mountain View, Calif.—Despite an early-90s slowdown in capital equipment spending, sales are increasing in the surface mount technology (SMT) market, and this growth trend is expected to continue, according to a recent Frost & Sullivan report.

(continued on p. 56)



For information circle 32



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Control system testing software from SST offers you a seamless approach to testing your valuable control systems before you go on-line.

Our proven technology gives you the power to test and correct your control systems off-line, so you can catch the bugs before it's too late! And off-line simulation gives you an effective, real time tool for operator training.

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For information circle **33**

CONTROL ENGINEERING

NEWS

The report projects that revenues in the world SMT manufacturing equipment market will grow from almost $3.3 billion in 1997 to over $8.8 billion in 2004. Trends in the SMT industry include: increased complexity and miniaturization of electronic components; faster assembly process and increased manufacturing of high quality; and more reliable electronics. Technologically, printed circuit board manufacturers are relying on information generated by automated inspection equipment software for process control, and more new components in the market are leading to heavy growth in fine-pitch and ball-grid-array equipment.

"The fastest growing geographic regions are North America and the Pacific Rim, and the contract manufacturing market and new components configuration is driving this growth," says Matt Saltz, Frost & Sullivan's SMT analyst.

Frost & Sullivan's study found several industry challenges in the two main customer segments in the SMT market: contract manufacturers and OEMs. These include increasing price competition due

(continued on p. 61)



Need flexible data exchange between serial protocols and/or networks? Our **3000 Series** converters help you control or monitor PLCs, motor drives, and other devices at a new level – inexpensively.

We can help you communicate with all types of industry-standard equipment, including DeviceNet, Profibus, Modbus Plus, and LonWorks Networks. And our Seriplex and AS-i gateway devices can give you new control options you haven't thought of yet.

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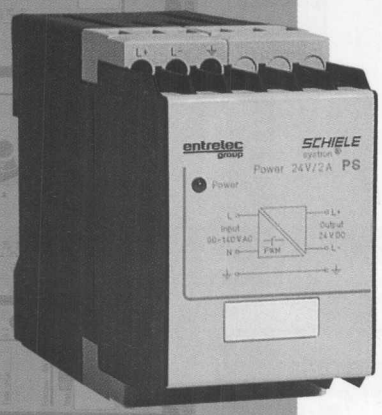
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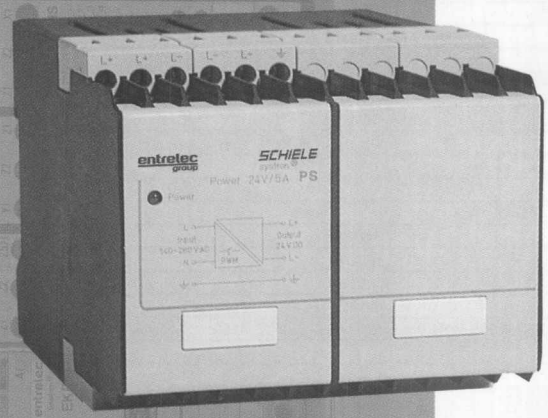
Switching Power Supplies from Entrelec

CE

CE POWER SUPPLIES

Compact switching power supplies, to 5A. DIN rail mounting for fast assembly.





New expanded line of switching power supplies delivers an output voltage from 5 VDC to 24 VDC, regulated, at an output current from 300 mA to 5A. Seven models, each **UL listed and CSA approved,** are CE marked and comply with the European EMC directives for electromagnetic compatibility, EN 50081-2 and EN 50082-2.

The fully enclosed, compact units measure only 45 mm or 90 mm wide. Most models accept a wide universal input range from 90 to 260 VAC, 47 to 440 Hz. Double clamp screw, touch-proof terminals ensure personnel safety.

Built-in overload and short circuit protection with automatic recovery eliminates the need for fuse replacement in the event of a load fault. A front panel LED indicator provides power-on status verification.

UL 508 listed. No derating in UL applications.

Ask for our new catalog.
See us at www.entrelec.com

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group

UL® CSA CE

Switching Power Supplies

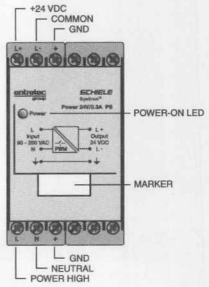
systron® PS

- DIN rail mount for fast assembly
- UL listed, CSA approved, complies with VDE 0160
- Voltage regulation Line ±0.1% to ±0.5%, Load ±0.5% to ±2.5%
- Overload and short circuit protection with auto recovery
- Fused input
- Universal input voltage range
- High efficiency
- Compact, only 45 or 90 mm width

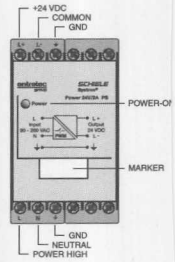
SWITCHING POWER SUPPLIES: 5 V

UL 508 listed. No derating in UL applications.





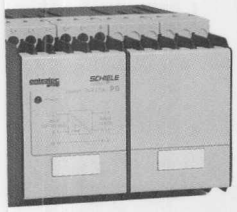


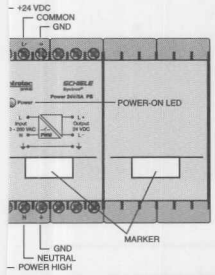


Characteristics	24 VDC, 0.3A	24 VDC, 1A	24 VDC, 2A
Part number	2 423 418.20	2 423 418.00	(140 - 260 VAC) (160 - 320 VDC) 2 423 417
			(90 - 140 VAC) 2 423 417
Approvals (Contact Entrelec)	UL, SEV, CE	UL, SEV, CE	UL, SEV, CE
Input Specifications			
Voltage	90 - 260 VAC, 105 - 370 VDC	90 - 260 VAC, 105 - 370 VDC	90 - 260 VAC, 160 - 320 VDC
Frequency, AC input	47 - 440 Hz	47 - 440 Hz	47 - 63 Hz
Transient response time	10 ms at 50% load change	10 ms at 50% load change	10 ms at 50% load change
Input voltage regulation	±0.5%	±0.1%	±0.5%
Output Specifications			
Output voltage	24 VDC ± 2%	24 VDC ± 2%	24 VDC ± 3%
Output current, at ambient temp.	T = 55°C	T < 45°C T = 55°C	T = 55°C
V_{in} = 90 - 100 VAC	0.3A	1A 900 mA	2A
V_{in} = 100 - 260 VAC	0.3A	1A 1A	2A
V_{in} = 105 - 370 VDC (*160 - 320 VDC)	0.3A	1A 1A	2A *
Ripple, max. peak-to-peak	< 100 mV	< 300 mV	< 300 mV
Load regulation	±0.5%	±0.5%	±0.5%
Overload/short circuit protection	Thermal	Thermal	Thermal
Efficiency, approximate	70%	84%	86%
Dielectric withstanding voltage	2500 VAC input-to-output to VDE 0160	2500 VAC input-to-output to VDE 0160	2500 VAC input-to-output to VDE 0
General Specifications			
Terminals	Screw type 2 x 14 AWG (2.5 mm²) max.	Screw type 2 x 14 AWG (2.5 mm²) max.	Screw type 2 x 14 AWG (2.5 mm²) m
Weight	0.22 kg (0.49 lb)	0.22 kg (0.49 lb)	0.3 kg (0.66 lb)
Hold up time	10 ms	10 ms	10 ms
Touch-proof / degree of protection	To VDE 0106 part 101 / Enclosure - IP 50 • Terminals IP 20		To VDE 0106 part 101 /
Noise immunity	← To IEC 801-2 (VDE 0843-2), test level 3 •		
EMC compatibility	EN 50081-2 (VDE 0839 T 81-2)	EN 50081-2 (VDE 0839 T 81-2)	EN 50081-2 (VDE 0839 T 81-2)
Radio interference suppression	EN 55011 Class A	EN 55011 Class A	EN 55011 Class A
Power-on indicator	LED, green	LED, green	LED, green
Ambient temperature *	Operating: 0°C to +55°C • Storage: -25°C to +75°C		Operating: 0°C to +
Overall dimensions W x H x D (see pg. 4)	45 mm x 78 mm x 100 mm	45 mm x 78 mm x 100 mm	45 mm x 78 mm x 120 mm
*** Outside of this temperature range, characteristics may vary. Please consult us.**			

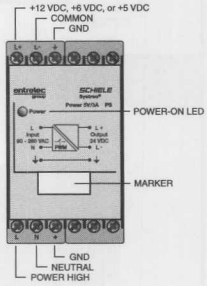
Accessories		Type		P/N	
1	Rail ⊔ 35 x 7.5 x 1 DIN 3	**PR30**	prepunched	**173 220.05**	
2	Rail ⊔ 35 x 15 x 2.3 DIN 3	**PR4**		**168 500.12**	
3	Rail ⊔ 35 x 15 x 1.5	**PR5**	prepunched	**101 598.26**	
4	BA End stop (all rails)	**BAM**	th 9.1 mm	**103 002.26**	
5	Redundant Power Supply Switching Module			**2 423 418.90**	Monitors two Entrelec switching pow to the alternate supply without interru

24 VDC output voltage, 300 mA to 5A output current









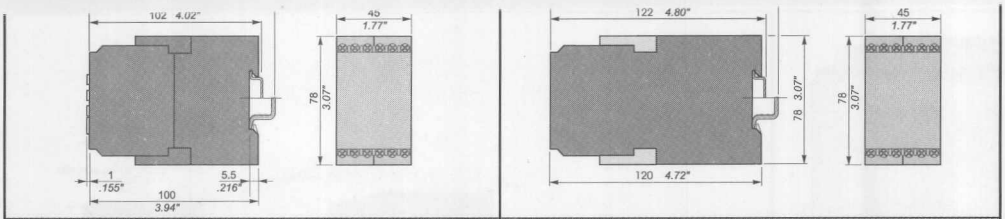
24 VDC, 5A	12 VDC, 2A	6 VDC, 3A	5 VDC, 3A
2 423 416.00	2 423 418.10	2 423 418.40	2 423 418.30
90 - 260 VAC	90 - 260 VAC, 105 - 370 VDC	90 - 260 VAC, 105 - 370 VDC	90 - 260 VAC, 105 - 370 VDC
47 - 63 Hz	47 - 440 Hz	47 - 440 Hz	47 - 440 Hz
0 ms at 50% load change	10 ms at 50% load change	10 ms at 50% load change	10 ms at 50% load change
±0.5%	±0.1%	±0.5%	±0.5%
24 VDC ± 3%	12 VDC ± 3%	6 VDC ± 2%	5 VDC ± 2%
< 40°C T = 55°C	T < 40°C T = 55°C	T = 45°C T = 55°C	T = 45°C T = 55°C
4A	2A 1.6A	3A 2.75A	3A 2.75A
4A	2A 1.8A	3A 2.75A	3A 2.75A
—	2A 1.8A	3A 2.75A	3A 2.75A
< 300 mV	< 300 mV	< 50 mV	< 50 mV
±0.5%	±0.5%	±2.5%	±2.5%
Thermal	Thermal	Thermal	Thermal
86%	83%	80%	80%
VAC input-to-output to VDE 0160	2500 VAC input-to-output to VDE 0160	2500 VAC input-to-output to VDE 0160	2500 VAC input-to-output to VDE 0160
v type 2 x 14 AWG (2.5 mm²) max.	Screw type 2 x 14 AWG (2.5 mm²) max.	Screw type 2 x 14 AWG (2.5 mm²) max.	Screw type 2 x 14 AWG (2.5 mm²) max.
0.8 kg (1.78 lb)	0.22 kg (0.49 lb)	0.22 kg (0.49 lb)	0.22 kg (0.49 lb)
10 ms	10 ms	10 ms	10 ms
0 • Terminals IP 20	To VDE 0106 part 101 / Enclosure - IP 50 • Terminals IP 20		
DE 0843-4), test level 4 • IEC 801-6 (VDE 0843-6), test level 3 • EN 50082-2 →			
I 50081-2 (VDE 0839 T 81-2)	EN 50081-2 (VDE 0839 T 81-2)	EN 50081-2 (VDE 0839 T 81-2)	EN 50081-2 (VDE 0839 T 81-2)
EN 55011 Class A	EN 55011 Class A	EN 55011 Class A	EN 55011 Class A
LED, green	LED, green	LED, green	LED, green
: -25°C to +75°C	Operating: 0°C to +55°C • Storage: -25°C to +75°C		
0 mm x 78 mm x 120 mm	45 mm x 78 mm x 100 mm	45 mm x 78 mm x 100 mm	45 mm x 78 mm x 100 mm

n up to 5A maximum. If one power supply fails, the module automatically switches
rent. Compact, 22.5 mm wide on the rail. See wiring diagram and photo, page 4.

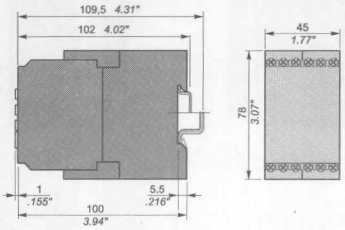
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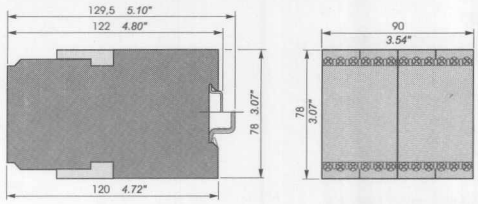
- DIN rail mount for fast assembly
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- Fused input
- Universal input voltage range
- High efficiency
- Compact, only 45 or 90 mm width



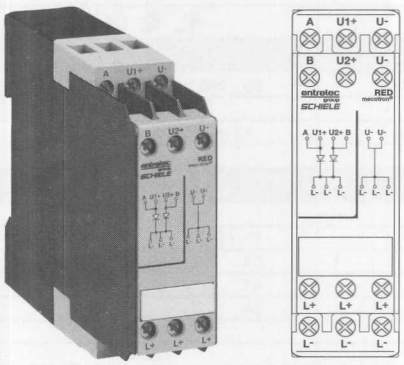
12 VDC, 2A / 6 VDC, 3A / 5 VDC, 3A



24 VDC, 5A



Redundant Power Supply Switching Module



Monitors two Entrelec switching power supplies, each up to 5A maximum. If one power supply fails, the module automatically switches to the alternate supply without interruption of load current. 22.5 mm W x 78 mm H.

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to contract manufacturers' squeezed profits, and their tighter control on capital investments, which is forcing equipment manufacturers to make improvements in the price/performance ratio of their machines. The report adds that contract manufacturing is exploding and new companies open daily. Contract manufacturers and the OEM market are also buying more fine-pitch equipment, since the industry is using more nonstandard components.

"Although many manufacturers are beginning to outsource their products, those that choose to continue to produce their own products must keep pace with the same trends that contract manufacturers are following," says Arne Johnsen-Sollos, Frost & Sullivan's SMT Analyst.

Allen-Bradley Automation Fair Breaks Attendance Records

Milwaukee, Wis.—The 6th annual Allen-Bradley Automation Fair, held November 1997 in Nashville, Tenn., broke its 1996 attendance record by 30%. A total of 9,540 visitors representing 48 states and 23 countries attended the annual event, which began in 1992.

At the opening ceremony, Don Davis, president and ceo of Allen-Bradley's parent company, Rockwell International, said the Automation Fair, "has become one of the premier trade shows for automation solutions." Attendees came from as far as Norway, India and other parts of Asia, and South America to see the 106 exhibitors representing Allen-Bradley and Rockwell Software brands, as well as the company's Encompass Program members.

Aside from the exhibits, the fair's 49 technical sessions and 20 hands-on training labs drew 12,200 guests total. Several new presentations spurred wide interest as well. "Automation Odyssey" showcased Rockwell Automation's product capabilities with a theater-like experience, while on of the most widely appreciated exhibit was the live coffee factory line. Using a fully integrated automation solution to roast, bag, and dispense premium blends of coffee, the grounds were then brewed and served to the presentation's audience.

Automation Fair '98 will be held on Nov. 18 and 19 at the Cervantes Convention Center in St. Louis, Mo.

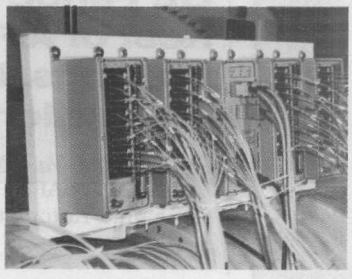
For more information, Circle 356 or visit www.controleng.com/info.

BEST PRACTICES

Intelligent Pressure Scanners Enhance Chillers

Minneapolis, Minn.—To help build more efficient centrifugal compressors for its chillers, McQuay International recently researched the thermodynamic state of HFC-134a refrigerant throughout the compres-

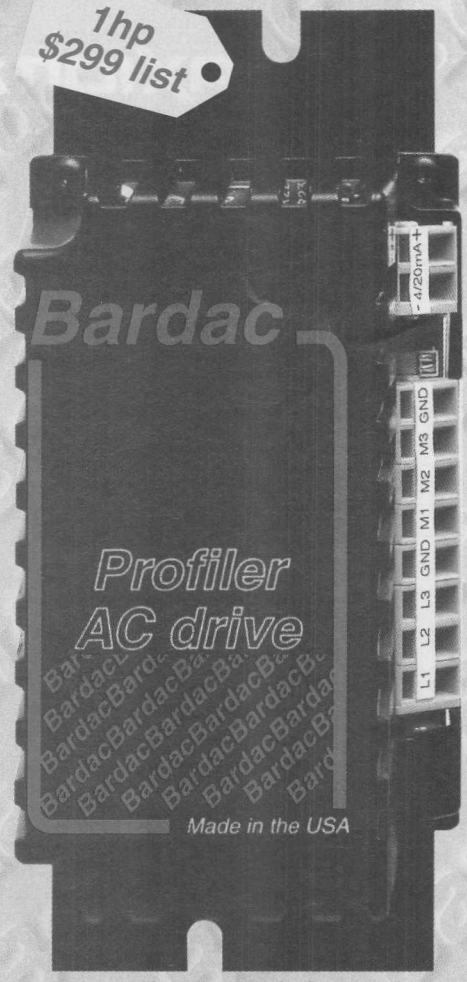
(continued on p. 62)



Model 9010 intelligent pressure scanner from Pressure Systems Inc. measures pressure during the compression process at McQuay International, which makes chillers using centrifugal compressors.

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sion process at its plant in Staunton, Va. The company discovered that conventional equipment was expensive and difficult to use, but eventually found and incorporated System 9000 intelligent pressure scanners from Pressure Systems Inc. (PSI, Hampton, Va.).

PSI's microprocessor-based, multichannel devices take multiple pressure measurements in conjunction with a direct PC interface. They can also be daisy-chained and networked to form a low-cost distributed data acquisition system.

However, because these scanners had never been used in an application where they were directly exposed to a refrig ant, the two companies agreed to te PSI's Model 9010 for its ability to me McQuay's needs. Despite the new me um, the scanners delivered accurate pr sure measurements throughout the tri This gave McQuay a new alternative mechanical pressure scanners or discr transducer equipment.

For more information, Circle 357 or v www.controleng.com/info.



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STANDARDS UPDATE

OpenDWG Alliance Formed to Make CA Files Accessible

Seattle, Wa.—Fourteen companies, r resenting CAD vendors and use announced Feb. 10 that they've form the OpenDWG Alliance to share exp tise on the DWG file format. The n association of vendors and users is p moting Autodesk's DWG drawing file f mat as an open industry standard for exchange of computer aided desi (CAD) drawings. To advance widespr access to DWG data, the alliance has a made publicly available the DWG s ware technology recently acquired Visio from MarComp Inc.

The Open DWG Alliance's memb include: Baystate Technologies Inc., I aCAD LLC, Diehl Graphsoft Inc., Ea Point Software Inc., IMSI, Informat Graphics Corp., Inso Corp., Intergra Corp., Ketiv Technologies, Nemetsch AG, Parametric Technology Co Robert McNeel & Associates, So Works Corp., and Visio Corp.

The OpenDWG Toolkit, wh includes C-language programmi libraries that provide read and wr access to DWG files, were made availa for download Feb. 11 at www.opend org.

IN BUSINESS

GE Fanuc Buys Rest of AFE Holdings, Forms Integration Team

Charlottsville, Va.—More than year a buying 70% of AFE Holdings in late 1 GE Fanuc Automation North Ame

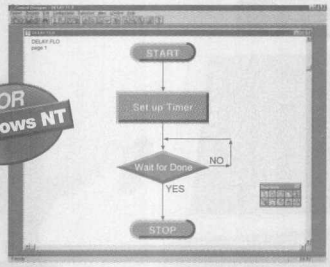
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Steeplechase offers the world's only Windows-based software that moves real-time PLC technology to the PC. Steeplechase now combines the Windows graphic interface with an ultra-fast, Intel®-based real-time operating system, providing ease-of-use and scan times 50 times faster than a PLC for demanding, high-speed applications. You get Windows flexibility with deterministic performance that Windows "soft logic" systems simply can't provide.

Integrated Diagnostics Reduce Downtime and Increase Productivity.

Flowcharts let you easily integrate in-line checks for machine faults or errors that display a simple corrective action that can be taken without programmer intervention. And simplified troubleshooting points you directly to the flowchart step the machine is executing. This empowers operators, engineers and electricians alike to perform maintenance and troubleshooting for greatly reduced downtime and resulting increases in productivity.

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NEWS

Inc. recently bought the remaining 30% of AFE.

A manufacturer of operator interface (OI) and software products with subsidiaries in the U.K., U.S., and Canada, AFE's products are now sold under GE Fanuc's family of Cimplicity OI products. These include flat-panel displays, touchscreen products, industrial PC-compatible computers, and pushbutton replacement products, which complement GE Industrial Control Systems products including drives, CNC, PLC, and motion control hardware lines. Steve Leonard was recently named Cimplicity OI's worldwide business manager. Mr. Leonard was formerly the Six Sigma quality leader for GE Fanuc.



In addition, to give process customers solutions as well as products, GE Fanuc recently formed its Product Integration Team. Based in Charlottesville, the team is technically integrating GE Fanuc's broad range of industrial products to address individual vertical market needs. A product integration technical center will be established there to develop and validate various vertical market solutions and gather customer feedback for further enhancements. Bob Rucinski is the manager of the Product Integration Team. Mr. Rucinski was formerly responsible for leading GE's Automotive Vertical Market Team.

The team will begin by tightly coupling GE and GE Fanuc products to improve interoperability. They will coordinate with all GE product marketing and engineering groups to develop advanced control solutions for targeted vertical markets. These solutions will include custom screens, features, and functions designed for particular application needs. GE will continue to focus on fast growing markets such as automotive, semiconductor, metals, water/waste water, oil and gas, and others. The team will also work with the GE vertical market sales team and system integrators to develop sales plans, technology requirements, and strategies for these markets.

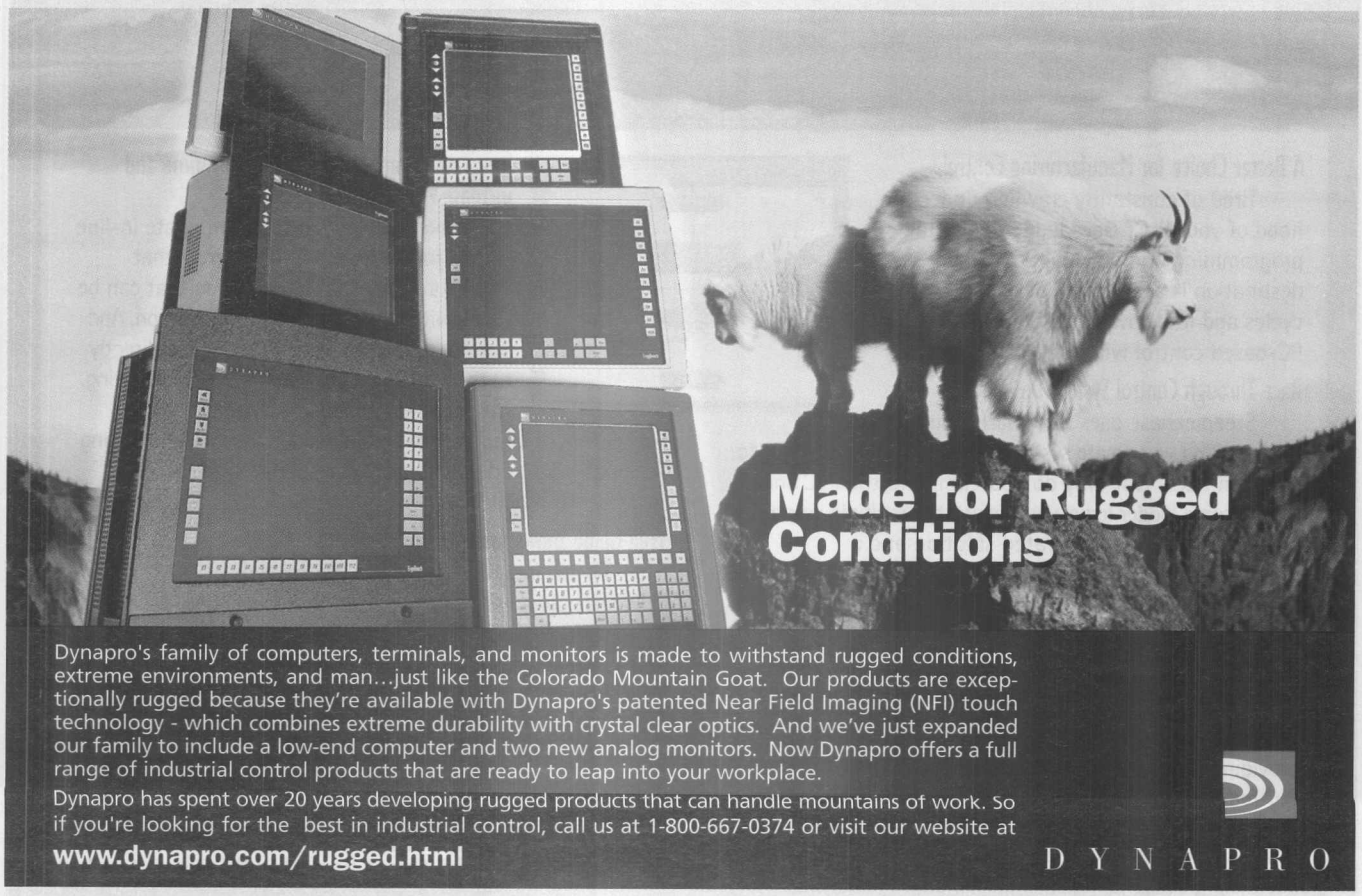
In addition, by the end of April, GE plans to have an advanced technical center for integration services in place at GE Fanuc. This integration lab will combine GE industrial hardware and software products and serve as a staging ground for customer interaction and feedback through demonstrations. Products in the lab will include: Series 16 CNCs, Series 90 PLCs, Genius intelligent I/O devices, Field Control I/O, and Cimplicity human-machine interface, PC control software, and DataPanel operator interfaces.

For more information, Circle 358 or visit www.controleng.com/ info.

General Signal's DeZurik Buys Honeywell's Control Valve Business

Sartell, Minn.—Customers of Honeywell Inc.'s North American Globe Control Valve business (Montgomeryville, Pa.) can

(continued on p. 66)

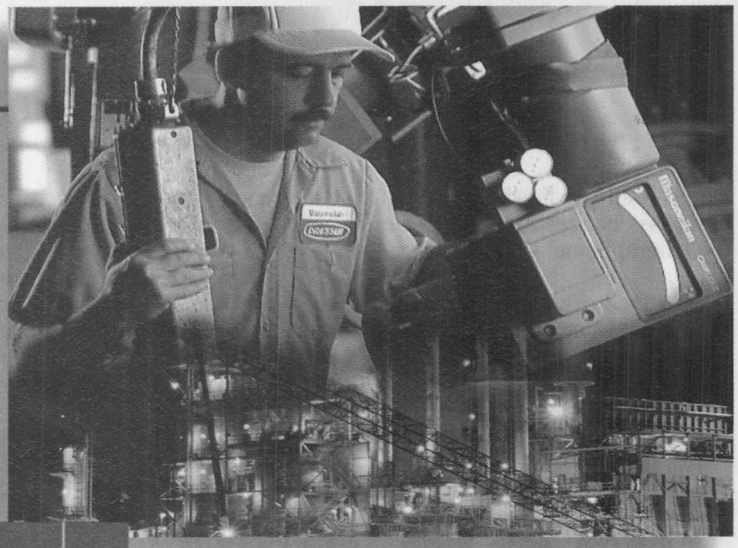


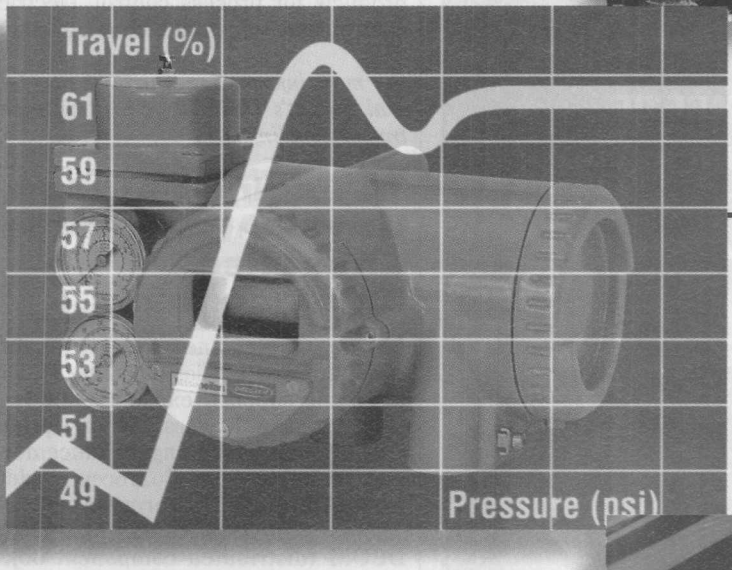
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expect a smooth flowing transition as that business changes hands from Honeywell to General Signal Corp., both companies say.

The DeZurik unit, based here, welcomes the December 1997 acquisition.

Wayne Robbins, DeZurik vice president of marketing and product development, says, "The line will contribute significantly to DeZurik's ability to offer its customers a broad, high-quality, 'best-in-class' selection of control valves, which include our traditional high-performance V Port Ball, high-performance Butterfly Valves, Precision Electric, and recent introductions: the Rotary Control Valve, the VDS Diagnostics System, and the Metal-Seated Ball Valve."

The Globe product line includes high-pressure single- and double-seat straight-through globes, angle valves, 3-way mixing/diverting valves, low-flow valves, tight shut-off and balanced cage globe valves (sizes from ½ to 16 in.), and a full range of actuators and positioners.

DeZurik's parent company, General Signal Corp. (Stamford, Conn.), with 1996 sales exceeding $2 billion, manufacturers products for process control, electrical control, and industrial technology industries.

For more information, Circle 359 for General Signal's DeZurik or visit www.controleng.com/info.

TA Engineering to Unveil AIMAX for Enterprise Enhancements

Moraga, Calif.—A new web server, datalogger historian, "alias" database for long tag name support, expanded soft-logic support, and a "keyless" software protection system are among enhancements that TA Engineering Co. recently added to its AIMAX for Enterprise software. These improvements use Microsoft's DCOM (distributed component object model) and ActiveX; SQL (structured query language) database support; and the TCP/IP (transmission control protocol/Internet protocol) networking functions of the Winsock (Windows Sockets) 2.0 specification.

"These new enhancements represent TA Engineering's commitment to be at the forefront of automation technology. Our company strategy is to provide the latest high-tech features at a low price. This allows our customers to appreciate the high performance of AIMAX, without being financially burdened," says Dr. T.A. Lu, TA's president and ceo. "For example, we are one of the first to provide ActiveX and DCOM functionality in our web server."

AIMAX for Enterprise is the latest human-machine interface software package designed for both large- and small-scale network applications. Following the guidelines set forth in Microsoft's Zero Administration for Windows (ZAW) initiative, AIMAX for Enterprise offers a lower total cost of ownership (TCO) in developing and managing HMI software. TA Engineering's TCO strategy is based

(continued on p. 69)



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For information on RSView 32 and the RSView32 Active Display System, call 1-800-455-8234, ext. 0660 or visit www.software.rockwell.com

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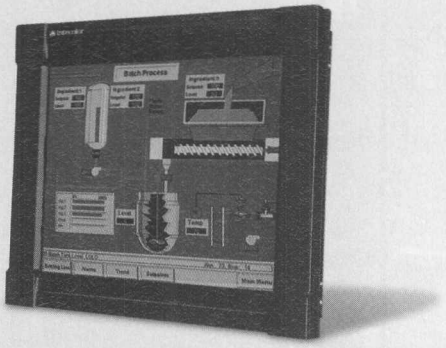
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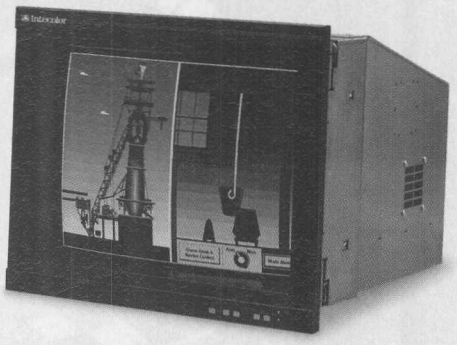
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Big. Tough. With a serial port connection that lets you control screen dynamics electronically. New H-Series monitors feature displays up to 21", auto-ranging power supplies, touchscreens, custom mounting, and other industrial options.

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The new H-Series: 20" and 21" industrial displays *and* all-digital control. The world's most successful industrial CRT monitors just got better. These are the best industrial monitors you can buy, and they're completely microprocessor controlled. *You* control color balance, amplifier gain and video format compatibility—without lifting a screwdriver or removing the case. Want to change settings? Check the internal temperature? Do it from a distance. And when you're up close, the big, bright screen makes complex displays easy on the eyes and touchscreens more navigable.

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on the Win32 API and Windows NT Server BackOffice, which allows the ZAW functions to be integrated into the process control environment. An added advantage, AIMAX software allows users to remotely login to the plant environment for remote management and runtime control. The environment is secured using a combination of Windows NT security and AIMAX Domain Network security.

For more information, Circle 360 or visit www.controleng.com/info.

FEEDBACK

CAN in Automation a Fieldbus Club Too

I read with high interest your cover story in the January 1998 issue of *Control Engineering* ["Connect to the Benefits of Digital Industrial Networks," p. 48]. I was surprised you didn't mention the CAN in Automation (CiA) International Users and Manufacturers Group, the most successful fieldbus club. Perhaps we are too independent—covering all the CAN-based solutions.

ODVA and Honeywell are CiA members—CiA is the umbrella organization for all CAN users. Last year, there were about 30 million CAN nodes sold, which is more than all the other bus systems together sold in their whole lifetimes.

CiA has developed the CANopen profile family, which can be regarded as a competitor to DeviceNet and Smart Distributed Systems. Nevertheless, we promote all of them because it is not the task of a user club to decide which is the best higher-layer protocol for CAN. In the U.S. and Japan, DeviceNet is better established than CANopen. In Europe, CANopen is more accepted, especially in the openOEM businesses and other control application fields, such as off-road vehicles, medical electronics, etc.

Holger Zeltwanger, CiA managing director, CAN in Automation International Users and Manufacturers Group, Erlangen, Germany.

Selecting Industrial Networks

I thought the article, "Selecting the Right Industrial Network," [*Control Engineering*, January 1998, p. 61] was both interesting and useful. We are in the process of swimming through the variety of selections that are out there. This article was helpful! Thank you!

Rick Tyson, electrical engineer, Salt Lake County Water Conservancy District, West Jordan, Ut.

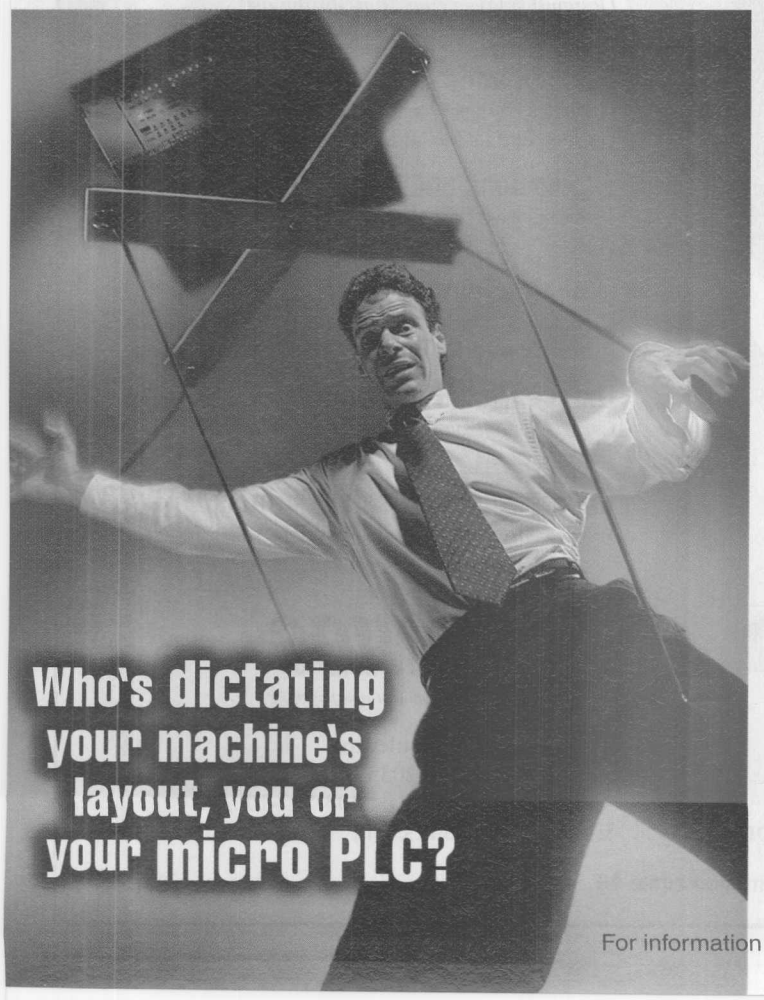
Insights on PE License

I saw a really well done article about the Professional Engineer designation written by Vance J. VanDoren P.E. in your January 1998 issue [*Control Engineering*, "Road to Engineer's License is Both Difficult and Worthwhile," p. 21]. The article succinctly summarized the P.E. program.

Mr. VanDoren also provides pertinent insight regarding several little-known aspects of the program one might encounter. Sufficient logistical detail and direction was also conveyed to the reader seeking to pursue the PE license. Well done!

George Merrithew, technical assistant, Instrument Services Department, Commonwealth Edison Technical Services, Maywood, Ill.

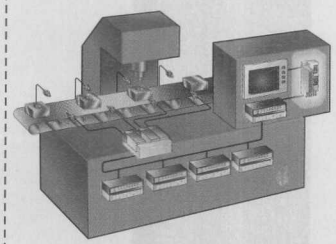
(continued on p. 71)





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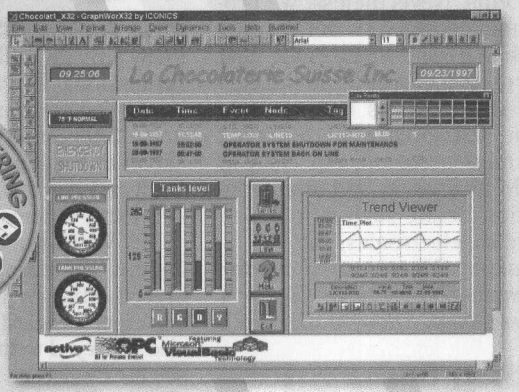
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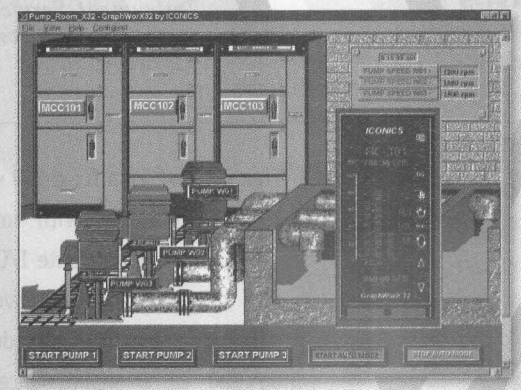
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NEWS

CORRECTIONS

In the "Product Focus/Programmable Logic Controllers" article in the February 1998 issue of *Control Engineering*, two percentage figures were switched from the sections of the pie chart on p. 113 that they should have occupied. However, the data they contain were correct.

In the same article, a table referred to on p. 126 was omitted for space considerations, but the reference to it was not deleted. The table contained the 10 most-cited communications protocols by *CE*'s survey respondents. See table above as it would have appeared:

COMMUNICATION PROTOCOLS NOW IN USE WITH PLCs

ArcNet	2.5%
ControlNet	6.7%
Data Highway+	59.2%
DeviceNet	9.2%
Ethernet	49.6%
Interbus	3.4%
LonWorks	0.8%
Modbus	30.3%
Profibus DP	5.5%
SDS	3.4%
Other	9.7%

[Total percentage exceeds base due to multiple responses.]

In the "More Users Consider Multivariable Transmitters" article in the December 1997 issue of *Control Engineering*, Yokogawa Industrial Automation was incorrectly named in the circle number section on p. 60. *Control Engineering* regrets the error.

EVENTS CALENDAR

For more meetings and industry news, see *Control Engineering* on-line at www.controleng.com/info.

NA '98, the North American Material Handling Show by the Material Handling Industry of North America, Cobo Hall, Detroit, Mich. Call 800/446-2622 or 704/676-1186; Web site: www.mhia.org. **March 30-April 2**

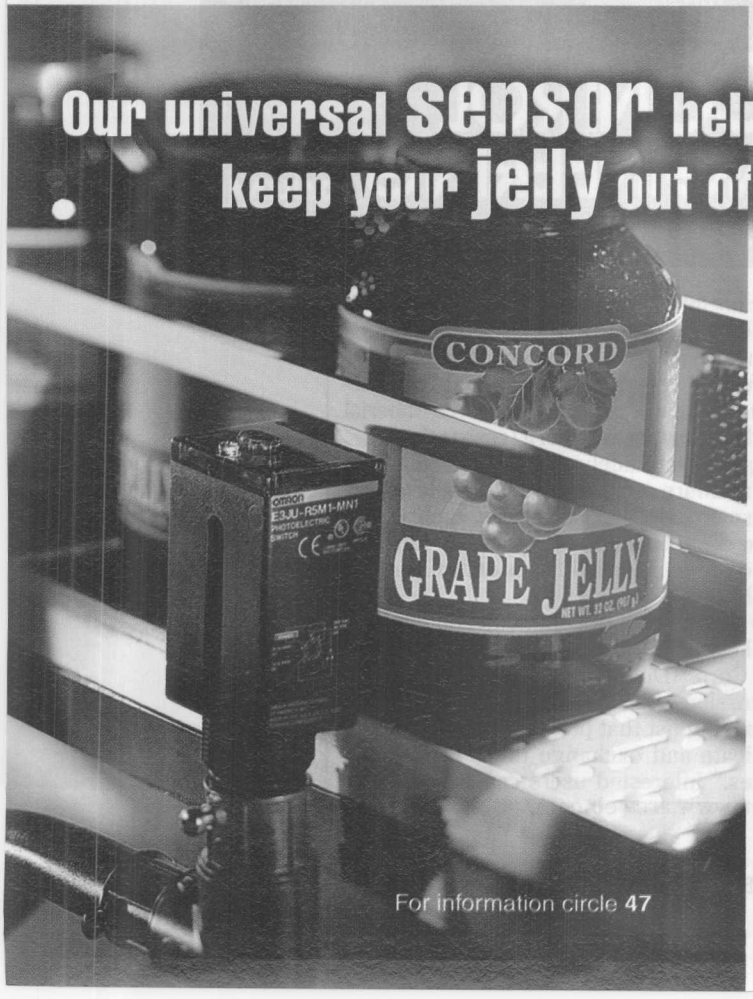
Hannover Fair '98, Hannover, Germany. Call Deutsche Messe AG at +49 511 89 0; Fax: +49 511 89 3 2626; Web site: www.messe.de. In North America, call Hannover Fairs USA at 609/987-1202; E-mailhannoverfair@hfusa.com. **April 20-25**

DSP Spring Design Conference for engineers designing commercial applications using DSP technology, Santa Clara Convention Center, Santa Clara, Calif. Call 415/538-3848 or 888/239-5563; E-mail: dspworld@mfi.com; Web site: www.dspworld.com. **April 21-23**

MES Roundtable 9, Open Manufacturing in the Network Age conference by MESA International, Sheraton Tara Hotel, Framingham, Mass. Call 412/781-9511; Fax: 412/781-2871; Web site: www.mesa.org. **April 26-28**

1998 World Batch Forum, 5th annual Meeting of the Minds conference, Hunt Valley, Md. Call 602/759-WB4M (9246); Fax: 602/759-6799. **April 26-29**

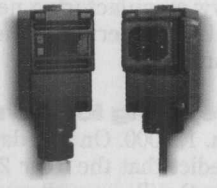
Automation Forum Plant Study Program, Allen-Bradley, Milwaukee, Wis. Call 703/841-3294; Fax: 703/841-3394. **May 6-8**



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CYBERPAGE

Instant Fulfillment Promises Fast Access to Product Information

Want information on products advertised in *Control Engineering* but don't have the time for mail-in reader service? The answer is Instant Fulfillment.

In addition to the current process of mailing in a reader service card and waiting for more information through the mail, readers can also access more information "instantly" on the web. (For those who do not have web access or prefer receiving information through the mail, Free Product Information cards are still provided in every issue.)

Through the Instant Fulfillment program, advertisers in *Control Engineering* provide web addresses (URLs) so readers may access online versions of company product brochures. These on-line brochures provide buttons for users to "page" through. Other buttons on Instant Fulfillment pages link to a company's e-mail, website, and listing in Manufacturing Marketplace's directory. So instead of waiting for product information, readers get more information "instantly." The ad index in the back of every issue of *Control Engineering* also lists advertisers' Instant Fulfillment URLs as well.

Manufacturing Marketplace:

The newly redesigned Manufacturing Marketplace website allows users easy access to a wide variety of manufacturing information. The home page features more direct links to featured content found in Manufacturing Marketplace's magazines, such as *Design News*, *Plant Engineering*, and *Modern Materials Handling*. The site features links to each magazine's directory of products and services, new products, latest news, and other magazine pages as well. Users can access Manufacturing Marketplace at www.manufacturing.net, or by way of the Control Engineering home page (www.controleng.com).

Preparing for the millennium

Jan. 1, 2000. On that day, some prophets of doom predict that the Year 2000 problem (or Y2K for short) will cause all computers to crash, threatening the civilized world. Others believe Y2K is an easy fix. Whichever view a person subscribes to, it isn't a problem that will fix itself (see *CE*, Feb.'98, pp. 61-68).

One thing is certain: Time is running out to solve the problem, and both small and large companies need to determine how it may effect them. They also need to know how to determine whether their systems are ready for 2000. Numerous sites on the World Wide Web provide information on Y2K for companies just starting to prepare, as well as companies well along in their efforts to stave off disaster.

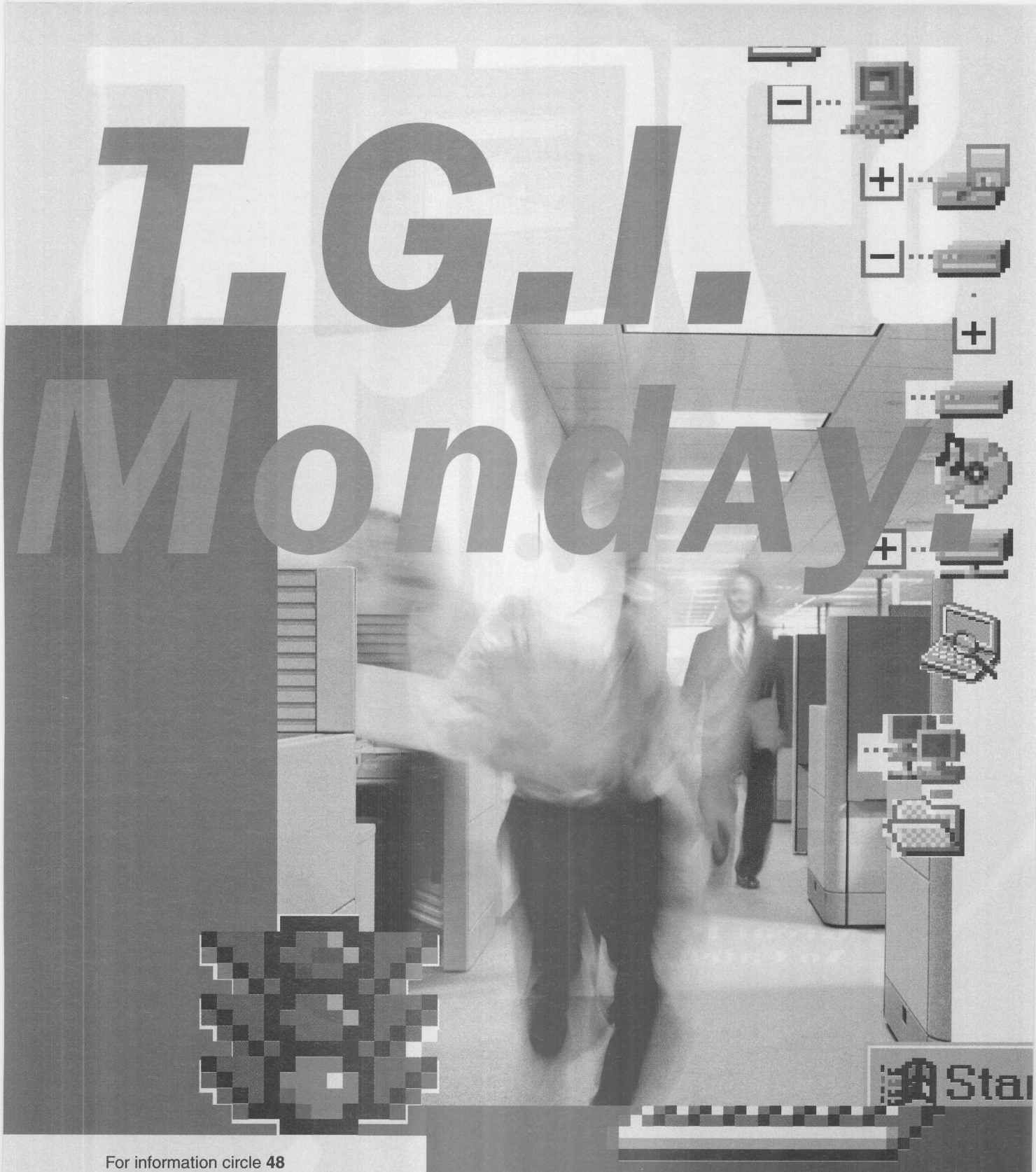
The web site of the Institution of Electrical Engineers (U.K.) provides detailed information on its "The Millennium Problem in Embedded Systems" page (www.iee.org.uk/2000risk/guide/home.htm). The site provides detailed information, starting with a definition of embedded systems and ways Y2K can effect them. It also provides guidelines for checking hardware and software compliance and how to test systems for it.



Another useful Y2K web site is from the MITRE Corp. (Bedford, Mass.), a not-for-profit systems engineering and integration company that runs two federally funded research facilities, and the Electronic Systems Center of the US Air Force Material Command, http:www.mitre.org/research/y2k/. This site provides guidelines for evaluating software and hardware compliance, and sample testing plans. It also provides helpful articles, such as estimating the costs of problem resolution. Links to compliance pages of several PC manufacturers are also available.

To provide a means of communication among industrial automation users, Automation Research Corp. (Dedham, Mass.) runs its Year 2000 Discussion List. The Year 2000 Discussion List is a mailing list that provides users a way to "communicate and exchange their Y2K-related experiences." Interested users can subscribe to the list at www.arcweb.com/public/contact/y2k.htm.

Matthew Bellm mbellm@cahners.com



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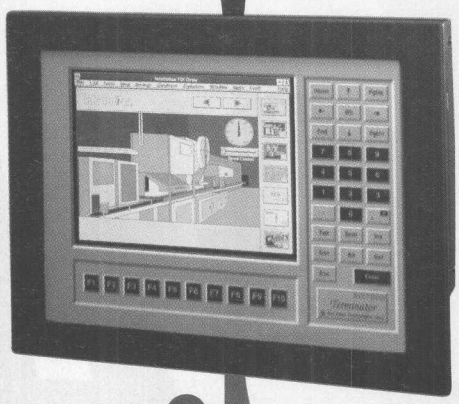
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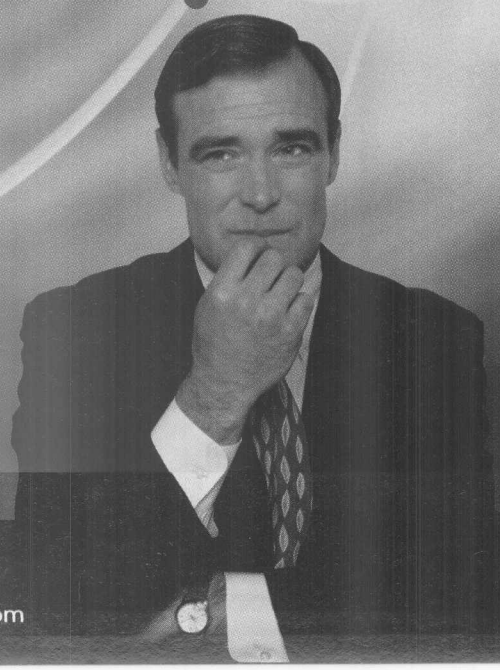
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EDITORIAL

The British Invasion



One if by land; two if by sea! It may not have been what our forefathers had in mind, but U.S. control companies should take note. The British are coming.

In February, two independent automation suppliers, both located in California, were acquired by companies in the U.K.

On February 6, Action Instruments, a $20 million supplier of signal conditioners, announced its acquisition by Eurotherm plc, a $350 million publicly held company specializing in temperature controllers, recorders, and drives.

Action Instruments' founder and owner, Jim Pinto, says the two companies share similar people and technology cultures. "We're both engineering-driven companies with investments in ASIC and I/O technologies. Eurotherm provides Action with European sales channels; Action provides the same for Eurotherm in the U.S. I'm committed to building this into a $500 million company in three years."

Why did Mr. Pinto, a well-known automation industry pundit, choose to stake his company's future on Eurotherm? Answers Jim, "When all else fails in a plant, the temperature controllers must keep working. With 350,000 shipments per year, Eurotherm owns the market for autonomous, self-acting, front-end temperature controllers. That's where I'm pitching my tent."

Software rules

Billed as a "marketing channel and customer acquisition," the second recent British invasion was the Siebe plc purchase of Wonderware Corp. The Berkshire, U.K.-based Siebe, an almost $5 billion engineering and electronics conglomerate, announced Feb. 24 its intention to acquire Wonderware for a hefty $24 per share cash offer, or about $375 million. Wonderware, which develops Microsoft Windows-based factory automation software, posted 1997 revenues of $82.5 million.

In the deal, Wonderware will become part of Siebe Control Systems, which now includes Foxboro, Barber-Colman, Triconex, and APV. Company executives, however, promise that Wonderware will not be "Siebe-ized."

Siebe ceo, Allen Yurko, and Control Systems Div. president and coo, George Sarney, assured industry press and analysts that Wonderware will maintain its own brand image as a free-standing business in Siebe. Says Mr. Sarney, "Siebe views HMI [human-machine interface] as a major market segment. This acquisition extends the operating range of Foxboro's I/A Series systems and its market segments."

Behind product, technology, and market synergies between the two companies stands the question—how will Wonderware and its distributors be treated by Siebe? In the short term, employees will be paid handsomely for their equity positions. For the future, the answer remains unclear. Siebe has a reputation for trimming costs and "redundancies."

Since its inception in 1987, Wonderware has excelled in two major areas. Its forebearers shared a passion for automation software and Microsoft platforms. Company founders leveraged this vision throughout a strong, international distributor network, which in turn built a loyal customer base.

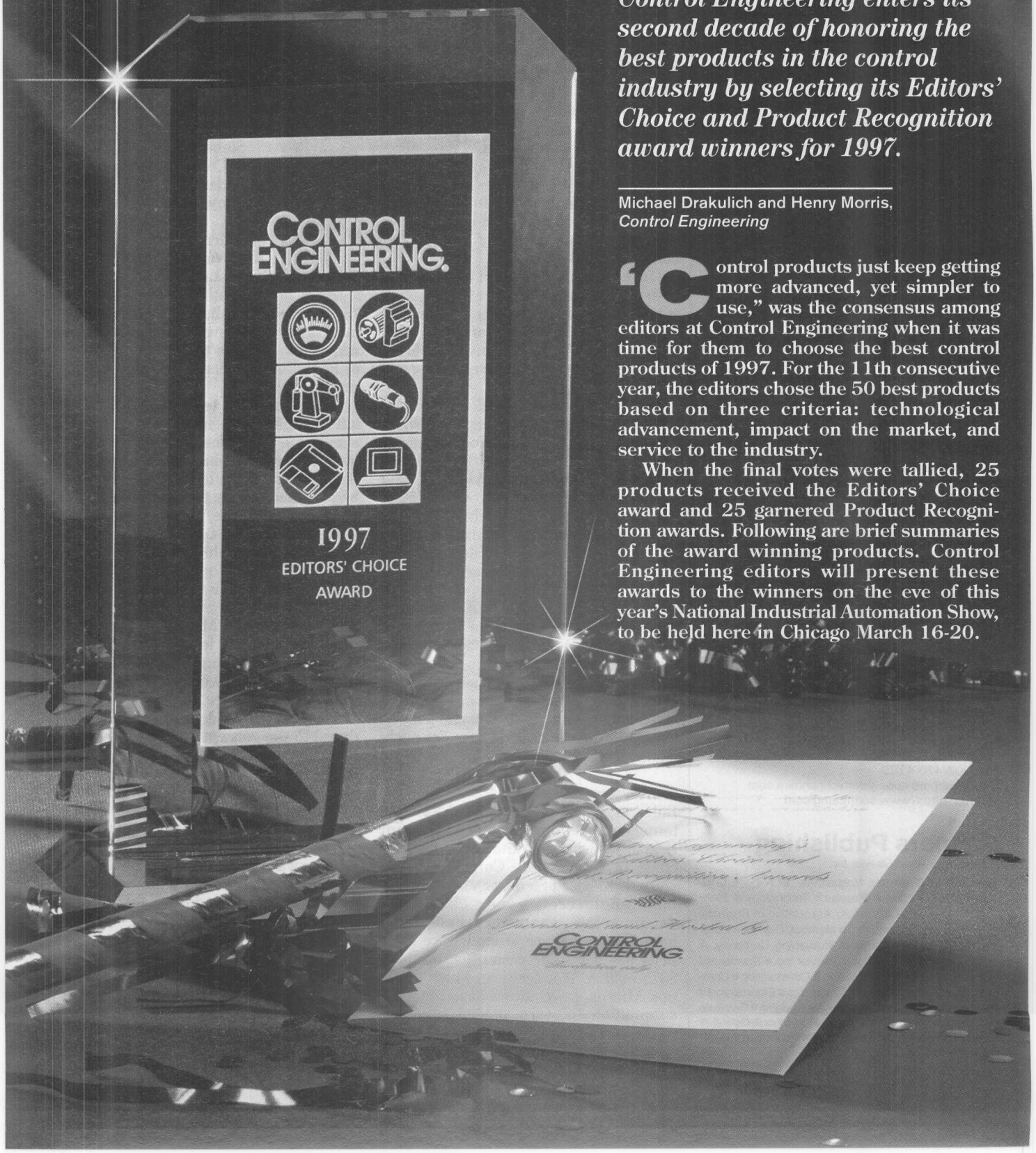
Many of our readers were first introduced to the concept of using Windows-based software on the plant floor by these early Wonderware pioneers. Can the passion stay alive through this acquisition?

Unlike the British invasion of the colonies in the 1770s, let's hope that Siebe will respect and nurture the spirit that is Wonderware in the 1990s. For it's that passion, common to so many ingenious companies in this industry, that breeds innovation.

Jane S. Gerold

Jane S. Gerold, Editorial Director
jgerold@cahners.com

May We Have the Envelopes Please



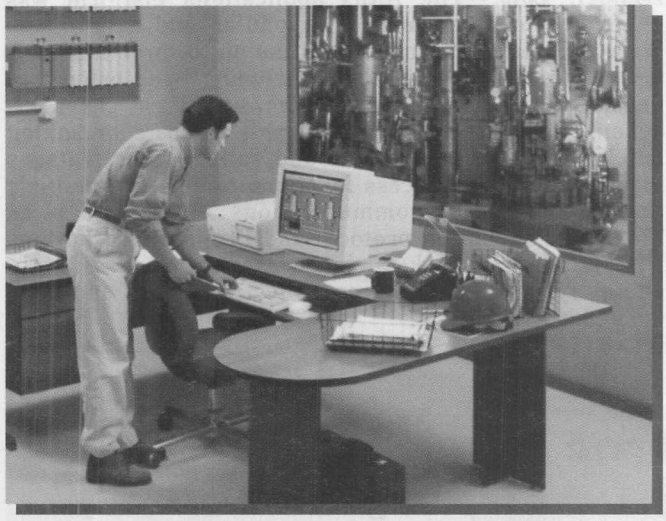
Control Engineering enters its second decade of honoring the best products in the control industry by selecting its Editors' Choice and Product Recognition award winners for 1997.

Michael Drakulich and Henry Morris,
Control Engineering

"Control products just keep getting more advanced, yet simpler to use," was the consensus among editors at Control Engineering when it was time for them to choose the best control products of 1997. For the 11th consecutive year, the editors chose the 50 best products based on three criteria: technological advancement, impact on the market, and service to the industry.

When the final votes were tallied, 25 products received the Editors' Choice award and 25 garnered Product Recognition awards. Following are brief summaries of the award winning products. Control Engineering editors will present these awards to the winners on the eve of this year's National Industrial Automation Show, to be held here in Chicago March 16-20.

Editors' Choice Awards

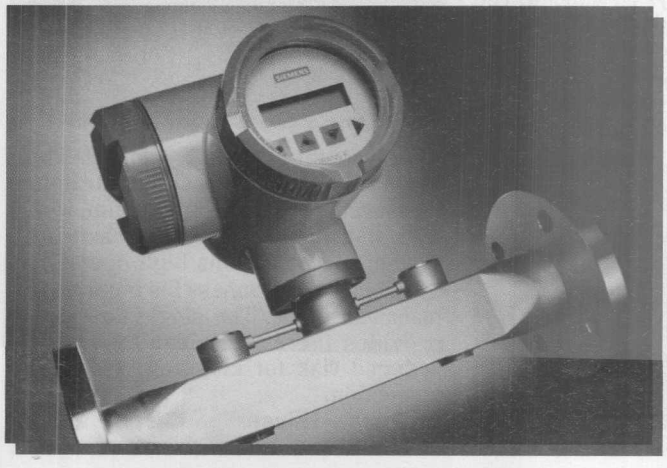


Software Solution for Hybrid Control

Phoenix, Ariz.—PlantScape has an advanced open architecture based on Microsoft's Windows NT operating system and the ControlNet network. It also has a hybrid controller with a control processor that integrates regulatory, fast-logic, sequential, and batch control functions, or a logic processor for high-speed (submillisecond) machine control. Configuration tools ease the development of reusable object-oriented control strategies.
Honeywell IAC **Circle 250**

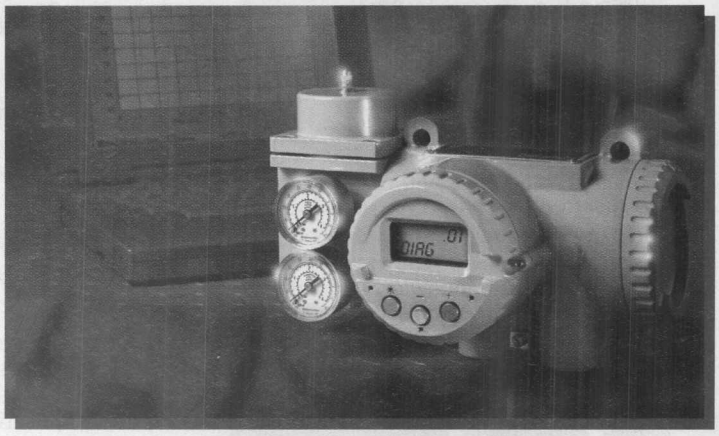
Flowmeter Uses Helical Sonic Pattern

Alpharetta, Ga.—The Sitrans F flowmeter can measure both laminar and turbulent flow. A helix shaped ultrasonic guidance system provides higher accuracy than one or two dimensional signals. Measurement is based on a tracking principle where the difference between echo times is analyzed upstream and downstream. Reflectors integrated into the tube wall deflect the sound beam laterally, and after reflecting several times, send it to the receiving transducer. The sound conduction pattern produced covers the entire cross section area of the flowtube and is claimed to be largely independent of the Reynolds number. Accuracy of ± 0.5% is promised over 25:1 ranges; ± 1% is promised over 100:1 ranges.
Siemens Energy and Automation **Circle 253**



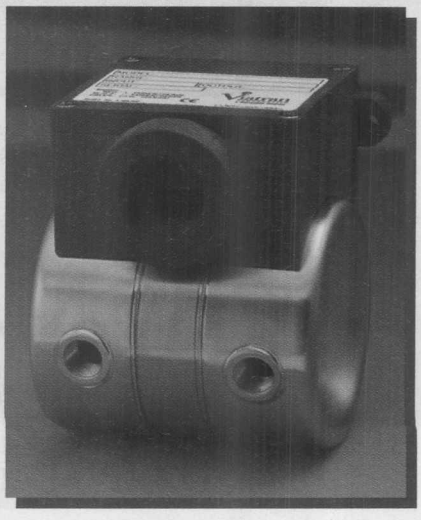
Valve Actuator Goes Digital

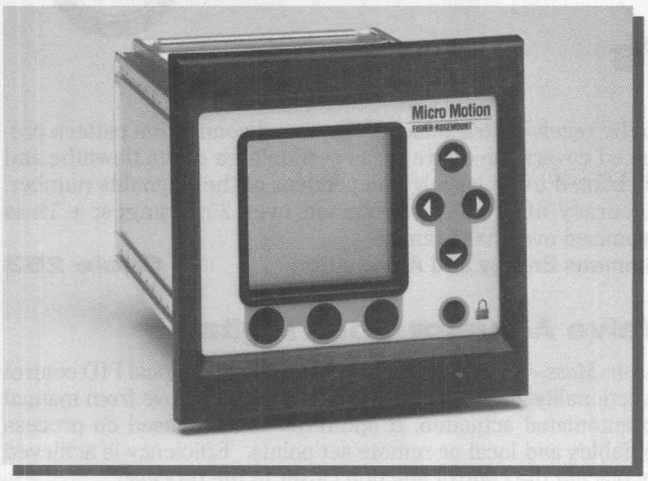
Avon, Mass.—Smart Valve Interface (SVI) uses local PID control functionality and control valve positioning to move from manual to automated actuation. It optimizes control based on process variables and local or remote set points. Efficiency is achieved by placing the control function closer to the process.
Masoneilan, Div. of Dresser Valve & Controls **Circle 251**



New Patented Technology for Measuring Differential Pressure

Grand Island, N.Y.—FerroCell is a patented technology for measuring differential pressure. Using Ferrofluid, the metal remains evenly distributed in the fluid until pressure is applied. These wet/wet products will function in harsh environments requiring corrosion resistant materials on both pressure ports, while withstanding high overload and static pressures. FerroCell products have a minimal number of machined parts, and a remarkably simple design for construction, decreasing the cost. The FerroCell offerings will include a unit for machine control, and two for the general process market, one of which offers the HART communications protocol.
Viatran Corp.
Circle 254





Applications Platform Becomes Modular

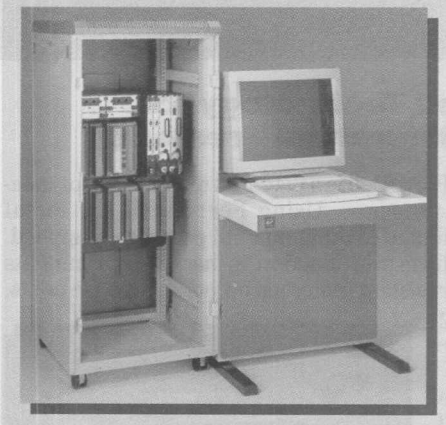
Boulder, Colo.—The Altus applications platform was developed to be expandable, modular, and easy-to-use. With integrated transmitter, it runs up to three measurements of control applications, including fixed or custom density, viscosity, net energy, sum/subtractor, customer-specific measurements, along with discrete or analog batch, flow-rate batch, PID and ratio. Other features include enhanced process functions to measure multiple process variables; communications options such as Fieldbus Foundation protocol and Profibus PA; buttons with tactile feedback; and accessories, such as high-energy relays, user interface protective covers, and field-mount heaters.

Micro Motion **Circle 252**

Product Recognition Awards

Process Control System

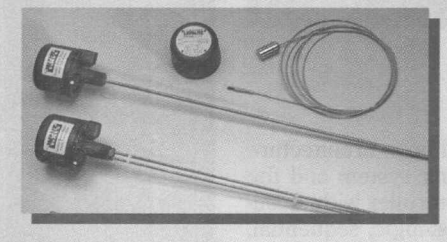
Newnan, Ga.—Centum CS 1000 was developed as an open and reliable process control system based on state-of-the-art information and network technology. It has a Microsoft Windows NT-based human machine interface, and powerful engineering tools such as a control simulator that allows complete control application testing on a desktop PC. The system uses Yokogawa's Centum CS bus for control, while offering fieldbus, multimedia, and Internet/intranet connectivity.



Yokogawa Industrial Automation **Circle 261**

Radar Level Transmitter

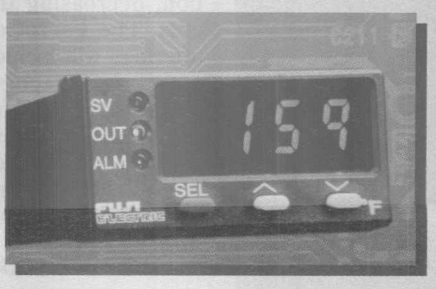
Port Huron, Mich.—The Wave radar level transmitter uses a miniature microwave design and boasts the most application insensitive device available. It is unaffected by minor coatings, vapors, changes in density or conductivity, and operates independently of liquid dielectric. The Wave was designed for applications where high accuracy, low cost, and application independence is required. It can be used in tanks, drums, and totes that can have a variety of chemicals present without adverse results.



The Levelite Store **Circle 259**

1/32-DIN controller

Williston, Vt.—PXV-3 1/32-DIN controller includes PID autotuning and fuzzy logic control, which use its developer's fuzzy-logic algorithms, ensuring that the process it controls stays on setpoint. The device has a NEMA-4X faceplate, 85 to 265 V ac input power, configurable menus, and eight-segment ramp/soak programming.



Total Temperature Instrumentation Corp. **Circle 260**

Single-Tube Coriolis Mass Flowmeter

Greenwood, Ind.—Promass I is said to be the first single-tube, full-bore, Coriolis mass flowmeter requiring no additional installation or mounting hardware. It is designed to monitor high concentration slurries and fluids where no shear force is allowed. The Promass I features a single straight measuring tube made of titanium, with a torsion mode balanced measuring system. Because of its high operating frequency, the Promass I is immune to plant vibrations. The single flow path provides increased cleaning safety, reduced risk for clogging, and easy inspection.



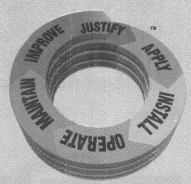
Endress + Hauser **Circle 255**

Pump It
Pack It
Wash It
Wrap It
Batch It
Bake It
Count It
Cap It

No matter what type of industrial process you manage, Allen-Bradley SLC 500™ controllers can control it — with a host of enhancements you may not have heard about.

Like Windows™-compatible RSLogix 500™ programming software. A growing selection of processors and discrete, analog and specialty I/O modules serving applications from simple relay replacements to complex processes. Plus, a broad choice of communication networks bridging the gap between the factory floor and management information systems.

And, of course, the same high quality, reliability and support you expect from Allen-Bradley. All designed to support your purchase decision throughout the Automation Investment Life Cycle™ stages. It's no wonder industries have made us the leading supplier of small programmable controllers.



Take control — with Allen-Bradley's SLC 500 controller family. For free information call **1-800-223-5354, extension 0645,** or visit us on-line at www.ab.com



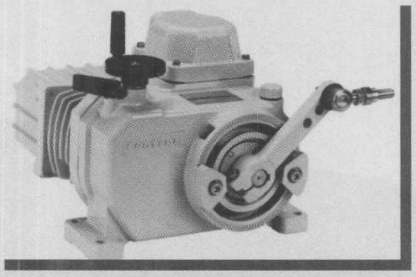
The SLC 500 Controller

Rockwell Automation
Allen-Bradley

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ADCIG0645

For information circle **50**

Product Recognition Awards (continued)



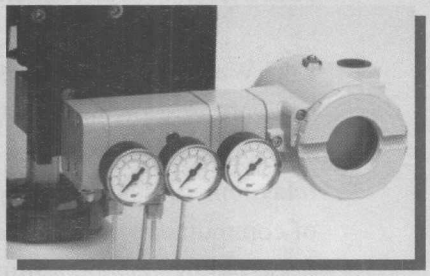
Intelligent Actuators for Process Automation

Frankfurt, Germany—Contrac is an intelligent control actuator based on conventional lever and linear actuators which include such features as continuous positioning, high degree of protection, long service life, and protection against overload in the end position without torque switch-off. Contrac combines mechanical actuator components with a microprocessor-controlled electronic unit. The resulting "intelligent" control actuator series is fieldbus compatible, permits diagnostic analysis, is self-monitoring, and permits fail-safe storage of technical data.

Hartmann & Braun AG **Circle 257**

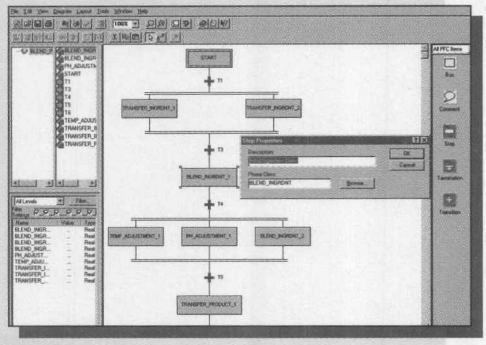
Fieldbus Foundation Compliant Positioner

Houston, Tex.—The FY302 positioner's design eliminates many mechanical parts, and its sensing is done without mechanical contact, virtually eliminating wear and tear, and subsequent degradation. Fieldbus Foundation compliant, it incorporates function blocks (PID), communication master capability, and continuous self diagnostics. **SMAR International Corp.** **Circle 258**



Recipe Studio Gives Users Better Batch Abilities

Austin, Tex.—Recipe Studio incorporates much of Fisher-Rosemount System's traditional batch expertise found in the DeltaV product line. Free from a DCS infrastructure, users can now work with such system technologies as COM/DCOM, object oriented analysis/object oriented design, and ActiveX. RecipeStudio has a single point for data entry and data sharing; modular structure for easier maintenance; client/server architecture that runs applications where appropriate; and an open structure that allows added components where required. It is expandable, so users can change component size when needed, and makes installing upgrades easier. Pictured is the Delta V Recipe Studio.



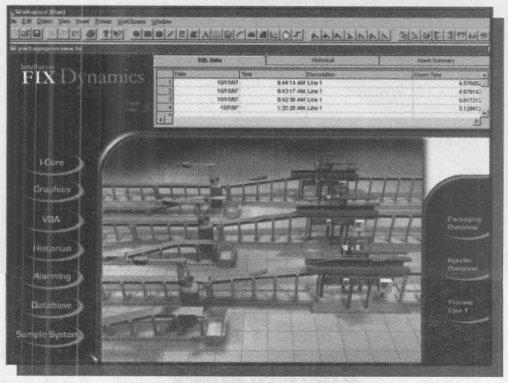
Fisher-Rosemount Systems **Circle 256**

HUMAN MACHINE INTERFACE

Editors' Choice Awards

Fully Integrated Component Object Solution

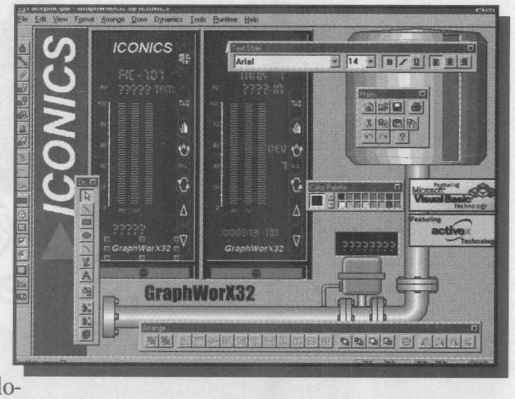
Norwood, Mass.—FIX Dynamics is a fully integrated software system designed to address both plant-floor needs and business issues. Its i-Core open, component-based framework is said to provide seamless integration of Intellution automation applications and third-party components without slowing down the manufacturing process. Custom coding is avoided since FIX Dynamics employs open industry standards such as Microsoft Windows NT, OLE, ActiveX, Visual Basic for Applications, OPC (OLE for process control), and COM/DCOM. Navigating from part of a system to another is made easy by using the Intellution WorkSpace interface.



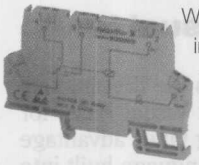
Intellution Inc. **Circle 263**

32-Bit 'Container'

Foxborough, Mass.—GraphWorx32 from Iconics is a virtual ActiveX container for HMI/SCADA applications. The scalable software is a fully compliant OLE for Process Control (OPC) application, developed to use Microsoft technology. GraphWorX32 uses Visual Basic for Applications 5.0 scripting language to create reports, recipes, and perform calculations based upon event-driven requests. The software can interact directly with Microsoft Office, BackOffice, and other Iconics products. Users can embed Microsoft Excel spreadsheets, Word documents, and Access databases directly into GraphWorx32 operator displays without having to import or export separately created screens. **Iconics Inc.** **Circle 262**



World's First 6 mm Tension Clamp Couplers



Weidmuller sets new industry standards with their introduction of tension clamp relay couplers and optocouplers in 6 mm-wide housings. No other supplier in the world today offers the same functionality in such a narrow design with tension clamp connection technology and cross-connection options.

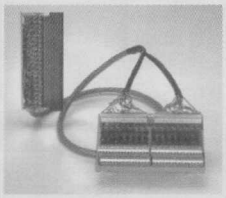
The new blocks make handling simple for even the most difficult installations. They can be used as a universal interface between the controller and sensor for feedback status. The new blocks provide three clear internal cross-connection options for looping power supplies and reference potentials. Touch safe, pluggable cross-connections are available in versions from 2 to 10 poles.

For more information, call Weidmuller at

1-800-849-9343.

For information circle **160**

New PLC Interface Products



Weidmuller expands its line of PLC Interface products, introducing new versions for Modicon's Quantum PLCs, GE Fanuc Series 90-70 and Series 90-30 PLCs, as well as Allen-Bradley's PLC-5 and SLC-500 PLCs.

Weidmuller's PLC Interface is a pre-wired, plug-in cable, which greatly speeds up the wiring process. By eliminating the need to hand-wire PLC I/O modules to the field interface termination point, it avoids system integration problems like wiring errors and loose wires.

The system consists of just three parts: a PLC-specific front panel adapter which plugs directly onto the PLC's I/O board; a field interface module containing passive or active I/O components; and a pre-wired jumper cable to connect the two. Weidmuller's PLC Interface products are UL-recognized.

For more information, call Weidmuller at

1-800-849-9343.

For information circle **162**

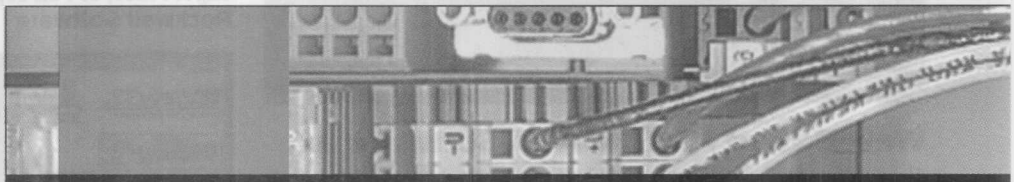
Surge Protection



Weidmuller's overvoltage and surge protection modules are prepackaged DIN-rail mounted solutions to overvoltage protection for control and power circuits used in automation and control systems. The devices feature DIN-rail mounted packages, screw terminal connections, wire markers, three-stage overvoltage protection using high voltage gas tubes, MOV, metal oxide varistors and Transorb diodes coupled together with filter chokes for suppression of the overvoltage effects of secondary lighting on control wiring.

For more information call Weidmuller at

1-800-849-9343 For information circle **161**

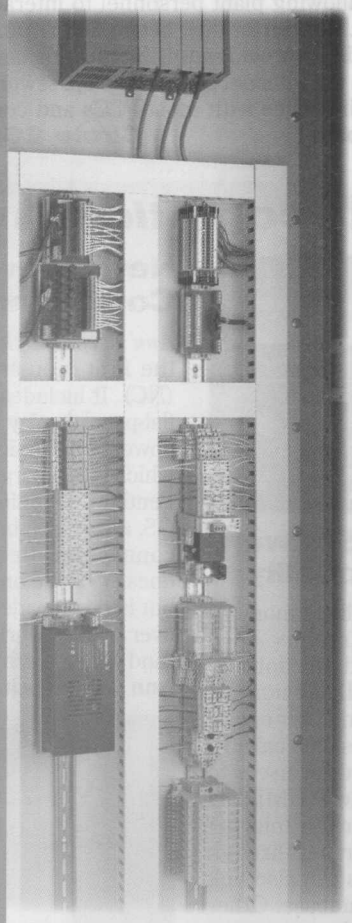


Complex Control Requirements . . .

WEIDMULLER CONTROL SOLUTIONS

As control devices multiply, safe and secure interconnection is a critical consideration for system designers. Flexibility to choose different solutions to meet control application demands is a must.

For more information on Weidmuller's wide variety of control solutions, just give us a call and ask for our Product Selection Guide and the name of your nearest Weidmuller distributor.



Weidmuller's DIN-rail mounted control system products are designed to maximize space, ensure tight connections, and facilitate fast and easy installation.

Choose Weidmuller terminal blocks, relays and optos, power supplies, signal conditioners, and surge protection devices for all your complex control requirements.

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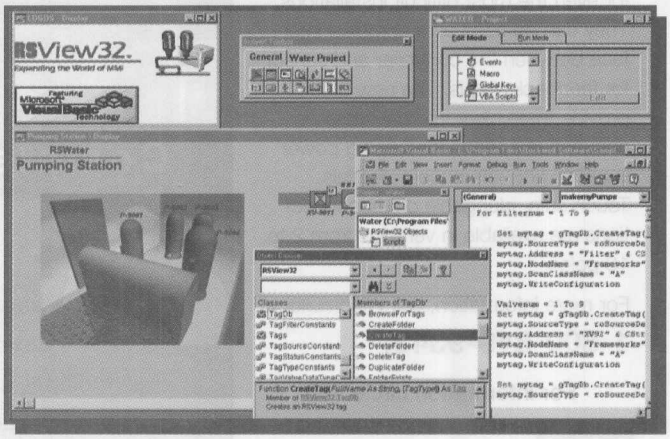


Web-Based HMI/SCADA Software ▲

Braintree, Mass.—Wizcon for Internet is said to be the first HMI/SCADA software designed to take full advantage of the latest Java technologies so plant personnel can interact with their processes from any remote location. Operating from a standard web browser, users deploy web-based SCADA stations, and all of their displays and alarms become accessible from any authorized station in the world, allowing plant personnel to interact with the process in real time. Wizcon for Internet is platform and computer system independent, provides full monitoring and control capability along with full Internet protocol and password security, and allows direct interface with most PLCs and controllers. **PCSoft International** **Circle 264**

HMI Software First to Use Visual Basic

Milwaukee, Wis.—RSView32 VBA Scripting is the first human-machine interface software to use Microsoft Visual Basic for Applications (VBA). RSView32 VBA Scripting takes advantage of VBA, the same programming and macro language built into the Microsoft Office97 software products. With VBA Scripting, RSView32 can interact directly with Microsoft Office, BackOffice, and Rockwell Software applications. The user can embed Microsoft Excel worksheets, Word documents, and ActiveX control into RSView32 graphics without having to import or export files, or run separate screens.
Rockwell Software **Circle 265**



Product Recognition Awards

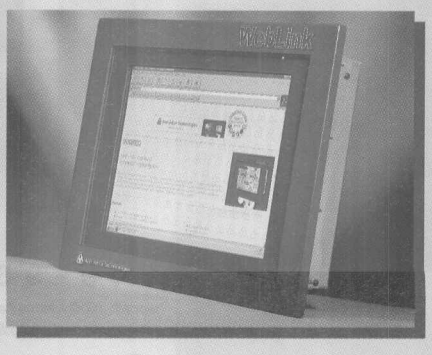


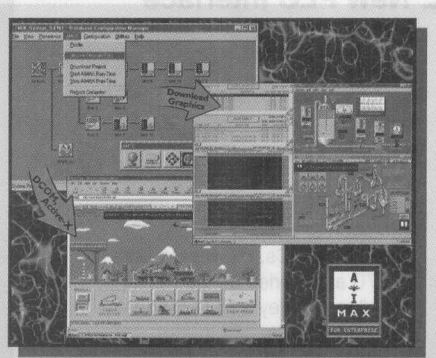
New Version of Software Expands Functionality

Charlottesville, Va.—Cimplicity monitoring and control software has been expanded to add increased functionality for users. Cimplicity HMI version 3.1 now has a historical data analyzer option which provides continuous data calculations, eliminating the need for users to program solutions. Cimplicity HMI data can now be accessed over the Internet or the user's company intranet through the gateway option. Users can also link Cimplicity to an Oracle database. Other options include a statistical process control option, drivers for additional device communication, and alarm logging to a network printer. **GE Fanuc Automation North America Inc.** **Circle 267**

New Network Computing Workstation

Ann Arbor, Mich.—WebLink is billed as the first industrial network computer (NC). It includes a 13.8 in. active-matrix flat-panel display with touchscreen, and is powered by a microSPARC IIe processor, which is comparable in power to a 75 MHz Pentium. WebLink also comes with Java OS, a Hot Java browser, and an Ethernet connection. Because the OI software doesn't reside on the WebLink NC itself, but is downloaded in the form of applets over the network, only 16 MB of RAM (and no hard drive) are required.
Ann Arbor Tech. **Circle 266**





OPC-Compliant HMI Software Package

Moraga, Calif.—AIMAX for Enterprise is a human-machine interface (HMI) software package that follows Microsoft's recent Zero Administration for Windows (ZAW) guidelines. Added to the package now is OLE for Process Control (OPC)-compliant applications. AIMAX is based in Win32 API and Windows NT Server BackOffice. Users can remotely log in their plants' system for off-site management and run-time control, or download data to components in hazardous areas. AIMAX is Windows NT-based and can work with any soft logic provider to perform flexible manufacturing.
TA Engineering **Circle 268**

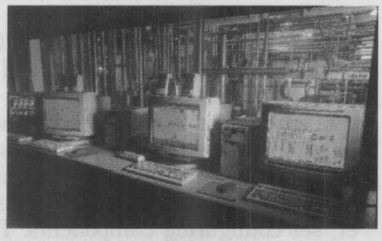
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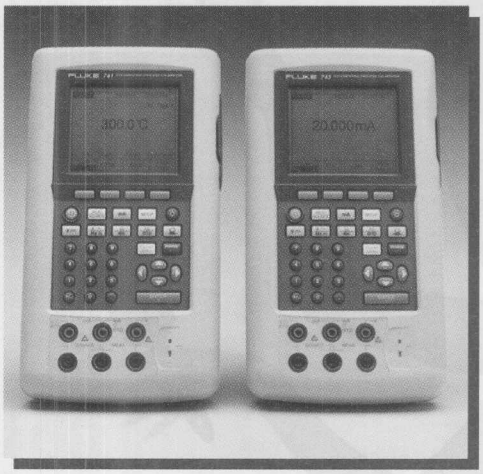
Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Canada, Chile, China, Columbia, Costa Rica, Czech Republic, Egypt, France, Germany, Greece, Hungary, Iceland, India, Italy, Israel, Jordan, MalaysiaMexico, Netherlands, New Zealand, Peru, Portugal, Puerto Rico, Scandinavia, Slovakia, South Africa, Spain, Turkey, UK, USA, Venezuela.

For information circle **52**

Editors' Choice Awards

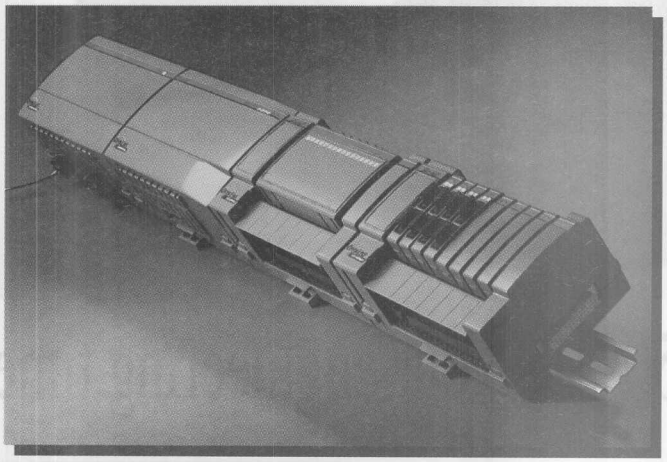
Documenting Process Calibrators Minimize Errors

Everett, Wa.—Multifunction models 741 and 743 documenting process calibrators are intended for use in the maintenance and calibration of process control instrumentation.

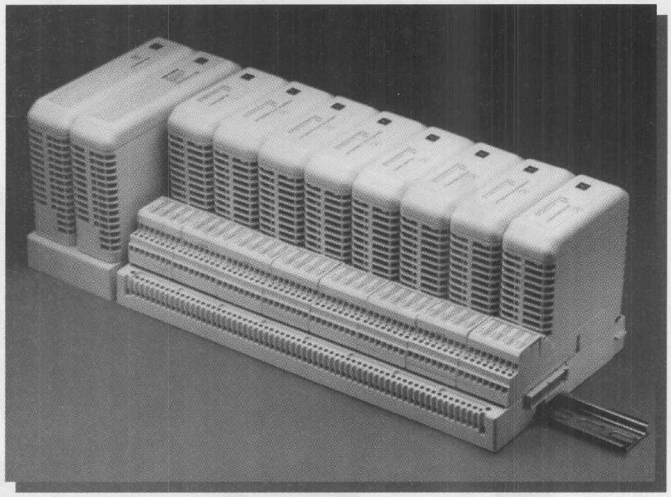


Embedded software, including "User-Entered Values" for both source and measure, makes it possible to document calibration of readout-only devices such as panel meters. The "Custom Units" feature allows the 740 Series to work with millivolt-output accessories and to document tests using units such as ppm, gpm, and more. Other software enhancements include user-defined lists, a square-root function (for DP flow), and a built-in calculator with source value setting. **Fluke Corp.** **Circle 324**

'Open' I/O System



LaGrange, Ill.—The OpenLine I/O and controller system networks with personal computers and "open" industrial network protocols. The system allows users to extend control over an extensive range of integrated applications while avoiding process information bottlenecks. Grayhill has integrated its next generation I/O system with PC-based controller technology and industry-standard networks. OpenLine system consists of five snap-together, self-configuring components. These include power supplies, controllers, I/O bases, I/O bricks, and dual-point I/O modules that share information over the high-speed parallel data bus. The intelligent I/O base constantly scans and stores each I/O type and its status. The OpenLine controller relies on an 80386 CPU and ROM DOS operating system. **Grayhill Inc.** **Circle 325**

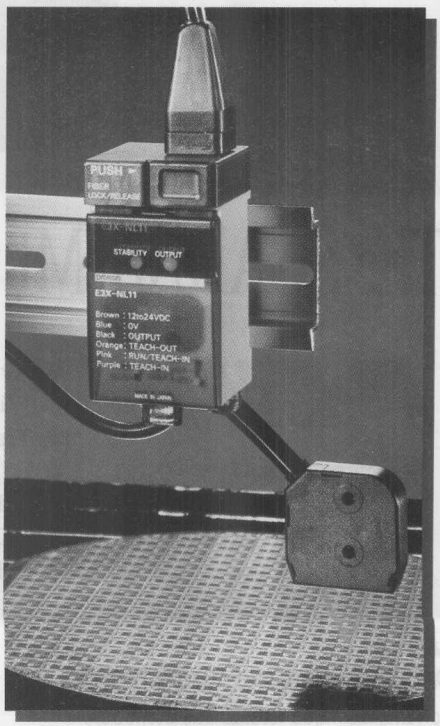


Distributed System is Intrinsically Safe

Hampton, N.H.—MTL 8000 handles process I/O and signal conditioning needs in the entire spectrum of plant environments, especially for intrinsically safe and harsh applications, providing a cost-effective solution for field-mounted I/O. It installs with a single connection to the I/O system. The system works in a temperature range of –40 to 70 °C. **MTL Inc.** **Circle 326**

Fiber-Optic Photoelectric Sensor Detects Luster

Schaumburg, Ill.—E3X-NL photoelectric fiber-optic sensor enables the detection of subtle changes in luster that have traditionally been very difficult to detect, such as circuit vs. non-circuit side of silicon wafers, glossy labels on paperboard, and grease on parts. The luster sensor heads feature two sensing ranges, 10 mm ± 3 mm for short sensing distances, and 20 mm ± 7 mm for longer sensing distances. A fuzzy logic teaching function changes the method of detection from glossiness difference to light value difference when variations in luster drop below a minimum detectable level. Sensor package consists of a sensing head and an amplifier.



Omron Electronics **Circle 327**

Don't sell me technology.

I've got too much. Tell me how we can run this plant at optimum capacity with fewer resources. Tell me how I can control costs on raw materials and energy – and how I'm going to re-tune everything when the market changes in six months . . . and then tell me how I'm going to explain it to management.



You can't fix the process unless you understand the business.

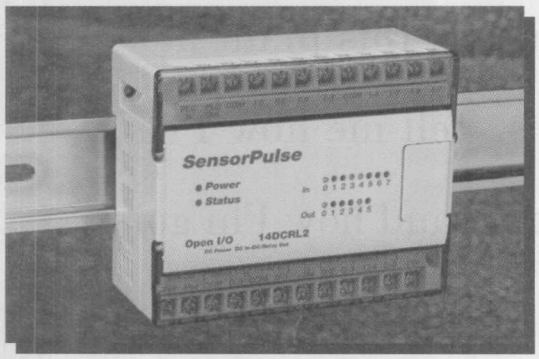
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CONTROL ENGINEERING EDITORS' CHOICE AWARD

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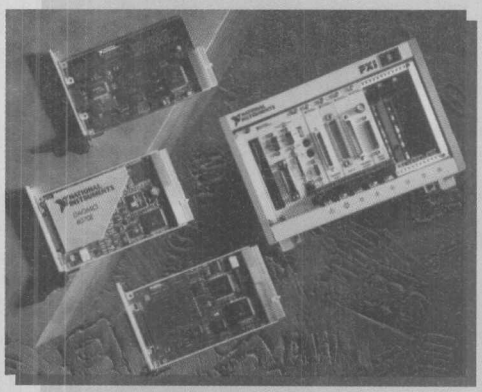
Signal Conditioning and PLC I/O Modules Have Wide Choice of Signal

South Easton, Mass.—Open I/O PLC I/O modules and OpenSignal signal conditioning modules offer terminal block shape and a wide mix of analog signal types for PLC I/O, networked PCs, and specialized signal conditioners. These modules provide three-way power isolation at 1,500 V, 0.1% accuracy, and channel-to-channel isolation, adding inputs and outputs to any PLC. The units can be factory configured by sensor type, range, and output type, with extended part numbers. Users may also configure the modules with Microsoft Windows and Windows CE-based Configuration Utility Software and a communications cable. OpenSignal signal conditioning modules come in six models; Open I/O PLC I/O modules come in seven models. **SensorPulse** **Circle 328**

Product Recognition Awards

PXI Extends Compact PCI Spec

Austin, Tex.—PCI eXtensions Instrumentation (PXI) extends the functionality of PCI and CompactPCI buses. PXI adds mandatory environmental testing and active cooling (use of fans) to the CompactPCI mechanical specification. Other differences include a hardware definition for Microsoft Windows NT and 95 as standard software frameworks; an integrated trigger bus and reference clock for multiboard synchronization; a



star trigger bus for precise timing; and local buses for sideband communication among adjacent peripherals. PXI products available from National Instruments include chassis, controller, data acquisition, image acquisition, instruments, and other interface products.
National Instruments **Circle 332**

Flexible Motor Supply Cable

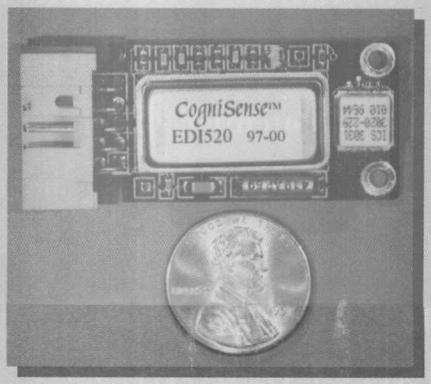
Detroit, Mi.—Olflex Cable has introduced a flexible motor supply cable for variable-frequency drives (VFDs) that withstands severe voltage spikes generated by harmonic distortions. This cable interconnects an ac VFD or control system to an ac motor. The cable is rated for use in both indoor and outdoor applications, and can operate in 90 °C dry/60 °C wet or oily environments.



Olflex Cable **Circle 333**

Modules to Make Sensors 'Smart'

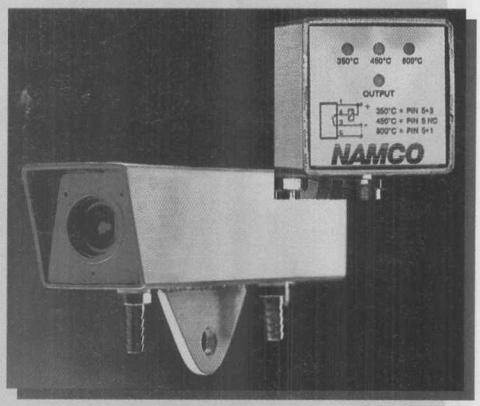
Columbia, Md.—The Smart Transducer Interface Module is designed to eliminate problems when connecting transducers to Network Capable Application Processors (NCAPs) compliant with IEEE P1451.2 standard. It combines signal conditioning and analog-to-digital conversion with a programmable microprocessor and enough memory to store the Transducer Data Sheets. The same device will also solve similar interfacing problems for the emerging IEEE P1451.3 interface standard for connecting analog transducers to NCAPs compliant with the IEEE P1451.2 standard.



CogniSense Div. of Electronics Development Corp. **Circle 329**

Hot Metal Detector is Multifunctional

Highland Heights, O.—The HotSpot multisetpoint hot metal detector (HMD) is said to be the first sensor of its type to offer field-selectable temperature setpoints. It simplifies stocking requirements because its adjustability makes it a "one-sensor-fits-all" product. The HotSpot is forgiving in certain applications where factors, such as background temperatures, are not as warm or cool as originally envisioned. The Hotspot claims to be the first static HMD that is PLC compatible. Its low leakage current of <1.7 mA eliminates the need for shunt resistors during installation or operation. The sensor's maker, Namco Controls, says the sensor is the first of its type that can be serviced.



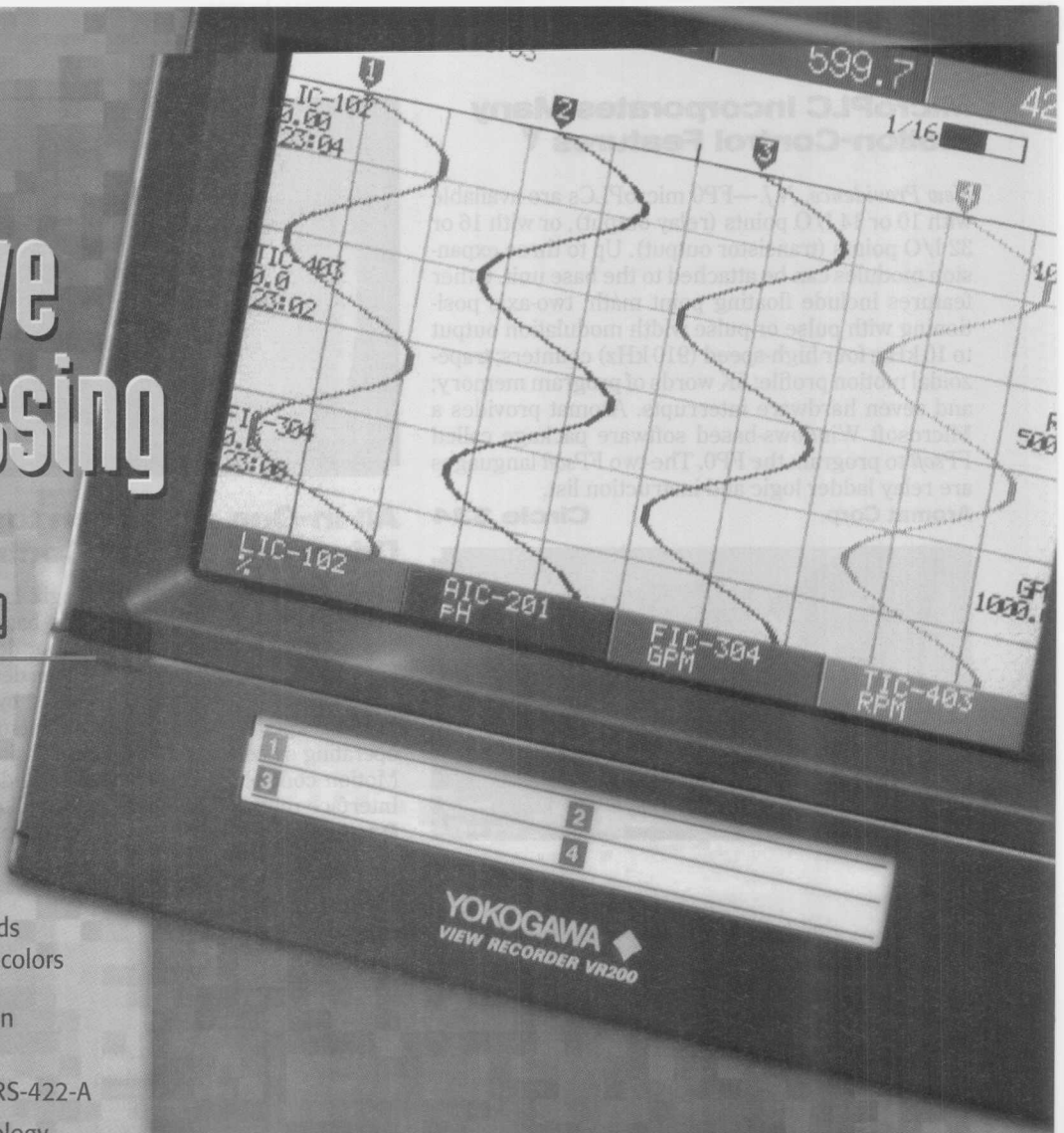
Namco Controls **Circle 331**

See What You've Been Missing

Introducing Full Feature Videographic Recording

If your recording needs have changed ... if you're looking for state-of-the-art, feature rich data acquisition technology ... look to the world leader. We listened, and delivered ... it's pixel perfect!

- Enhanced viewability:
  - Horizontal or vertical traces
  - 3 selectable screen backgrounds
  - Selectable trace thickness and colors
  - Real-time and historical information on the same screen
  - 15 brightness settings
- Connectivity to other systems via RS-422-A
- Easiest-to-use videographic technology
- Migration path to new data acquisition solutions
- Up to 66-day on-line data storage – easy transfer to diskette
- **#1** ranked customer service to support your applications

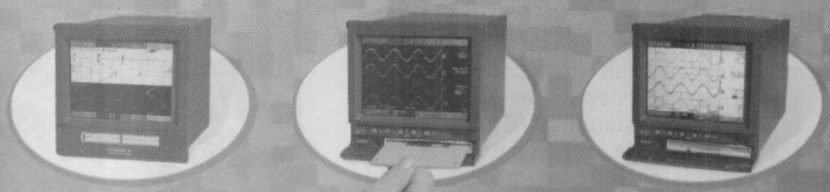


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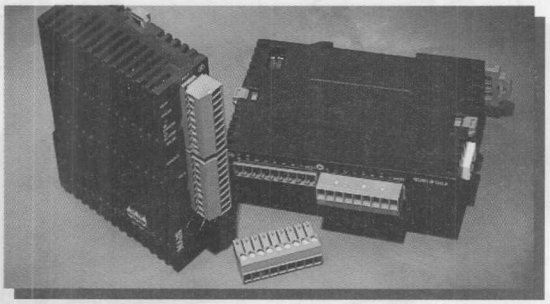
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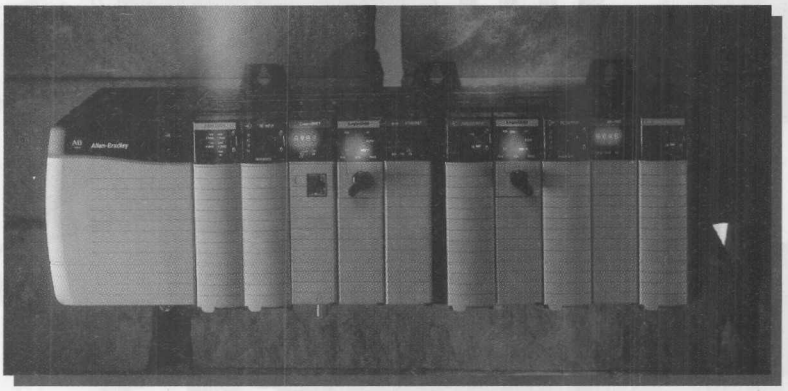
Editors' Choice Awards

MicroPLC Incorporates Many Motion-Control Features ▼

New Providence, N.J.—FP0 microPLCs are available with 10 or 14 I/O points (relay output), or with 16 or 32 I/O points (transistor output). Up to three expansion modules can be attached to the base unit. Other features include floating point math; two-axis positioning with pulse or pulse width modulation output to 10 kHz; four high-speed (910 kHz) counters; trapezoidal motion profile; 5K words of program memory; and seven hardware interrupts. Aromat provides a Microsoft Windows-based software package called FP*soft* to program the FP0. The two FP*soft* languages are relay ladder logic and instruction list.

Aromat Corp. **Circle 334**





All-In-One Approach to Logic, ▲ Drive, and Motion Control

Mayfield Heights, O.—ControlLogix family of PLCs employs a high-speed, multimaster ControlBus backplane based on the ControlNet network, which allows multiple processors and other devices to communicate simultaneously. Network communication has been decoupled from the controller, and gateways for new networks can be added by simply plugging them into the common backplane. The controller's memory is modular, and a multitasking operating system handles up to 32 tasks that can be prioritized on 16 levels. Motion control no longer needs a dedicated processor. The system's Axis Interface modules fit into the ControlLogix chassis like other I/O modules.

Rockwell Automation/Allen-Bradley **Circle 335**

Product Recognition Awards



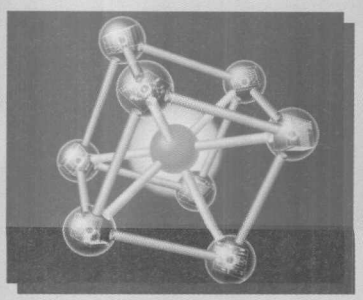
Internet-Capable PLC

North Andover, Mass.—Schneider Automation boasts the first PLC-based web server that demonstrates the direct link of a PLC to the Internet. Users can now access multiple remote sites through the Internet with a Quantum PLC. The server provides PLC Configuration (register types and ranges), PLC 4X Register Values, and Ethernet Statistics from a live Modicon TSX Quantum automation controller operating online in a company development laboratory. The PLC, a Quantum NOE 211 Ethernet TCP/IP module, can be the web server; it embeds an Intel 386 processor and reads configuration and register information from the Quantum CPU memory.

Schneider Automation **Circle 337**

Totally Integrated Automation

Nuremburg, Germany—Totally Integrated Automation is a new class of automation products and systems for the manufacturing and process industries. It consists of controllers, operating and monitoring devices, communication devices, and process control systems. Totally Integrated Automation brings the benefits of both PC-based and PLC-based systems, and enables the complete integration of an organization's entire automation setup; from goods inward to the packing machine, from the human-machine interface to the fieldbus. **Siemens Automation Group** **Circle 338**

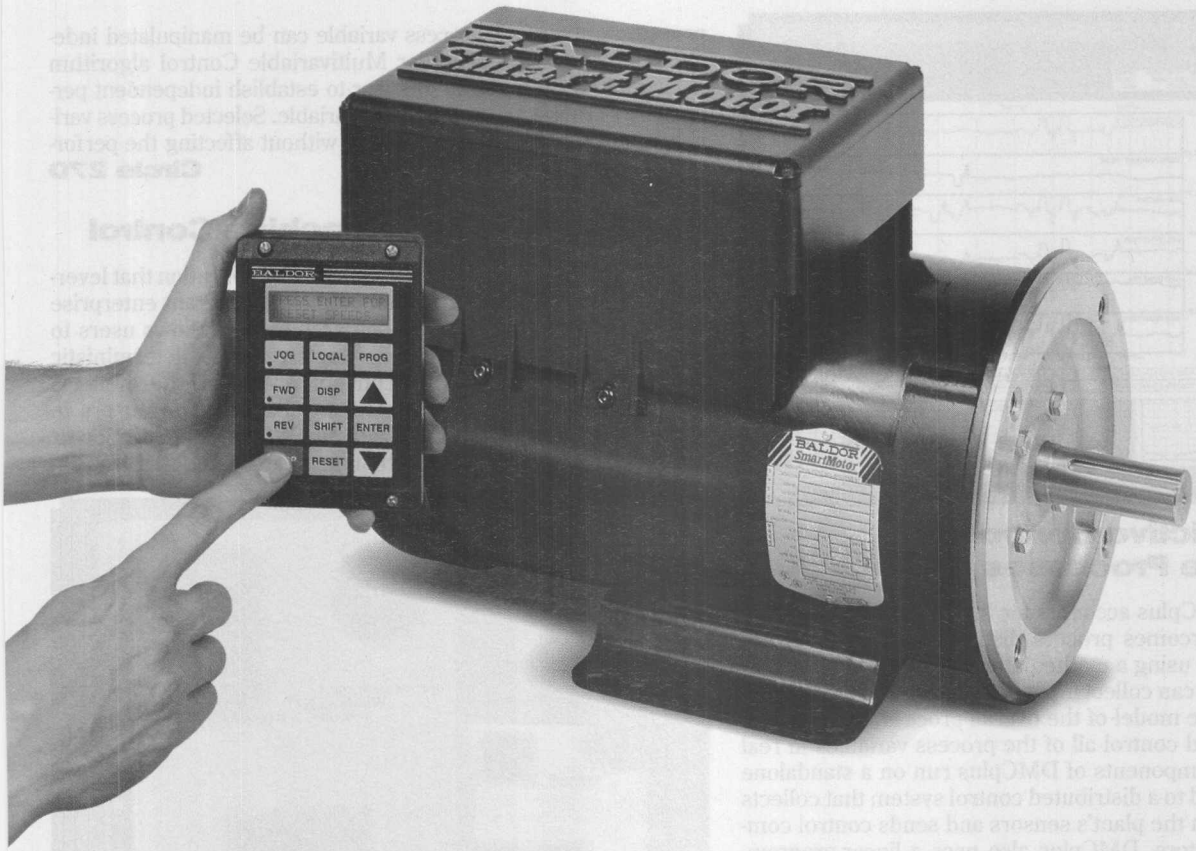




Smart Pneumatic Valve Manifolds Embedded with Controller Technology

Hauppauge, N.Y.—Festo's new line of smart pneumatic valve manifolds incorporates the full processing and control functionality of an A-B SLC 5/02 programmable logic controller in a modular pneumatic valve manifold. This makes them a self-contained control solution for stand-alone or networked systems, using either Allen-Bradley DH-485 or the DeviceNet protocol. A-B SLC-5/02 control logic is at the core of the SLC embedded pneumatic manifold, enabling users to apply their existing knowledge and experience with Allen-Bradley software to program the valve manifolds.

Festo Corp. **Circle 336**



Introducing the Baldor *SmartMotor*.™ The easiest drive you'll ever use.

The Baldor SmartMotor™ isn't just an inverter bolted onto a motor. It's the most closely matched motor and control available today, in one easy-to-use package — Matched Performance™ at its best. Compatibility problems are simply eliminated.

The Baldor SmartMotor™ also completely eliminates voltage ring-up at motor terminals, a common cause of inverter-related motor failure.

Programming the Baldor SmartMotor™ is easy, too, thanks to the keypad language common to all Baldor drives. The 32 - character keypad uses simple commands and prompts in plain English.

The Baldor SmartMotor™ interfaces with the RS485 communications standard and is available in 1 HP - 10 HP, 230 and 460 volts, 4 pole, TEFC.

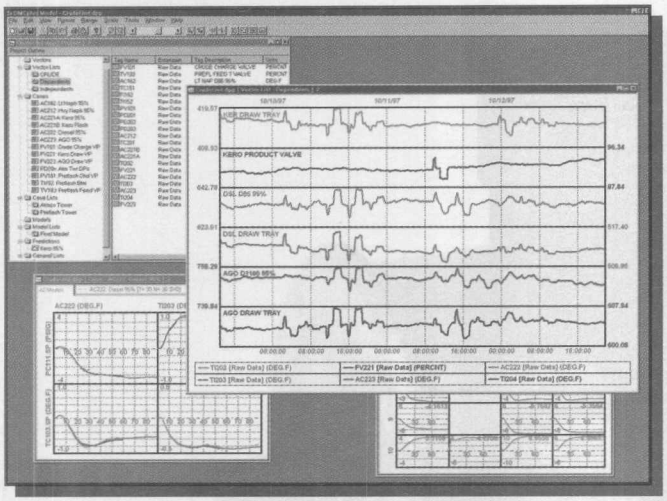
Plus, installing the Baldor SmartMotor™ is faster and less expensive than the double installation of separate motors and controls. You don't have to buy connecting cable or a panel to house a stand-alone control.

Find out just how brilliantly the Baldor SmartMotor™ can perform for you. Contact your Baldor distributor today. Or you can call our toll-free Literature Hotline at 1-800-828-4920. Contact us via the World Wide Web at www.baldor.com.

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MOTORS AND DRIVES

Our job is making yours easier.
For information circle **55**

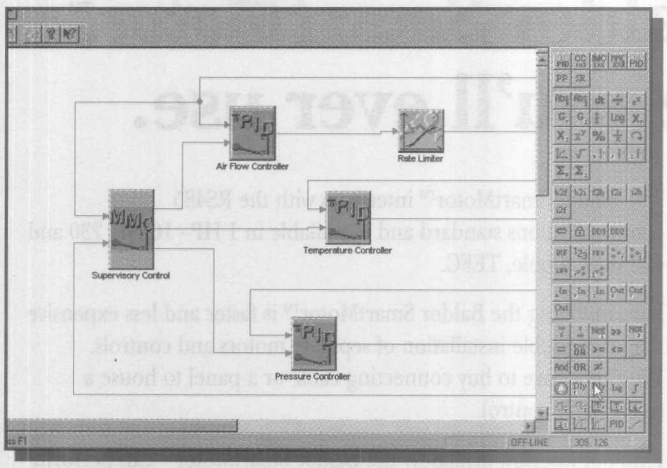
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Model-Predictive Control for Multivariable Processes

Houston, Tex.—DMCplus accounts for interactions among multiple variables, overcomes process disturbances, and predicts future performance using a mathematical model of the process' behavior. DMCplus can collect input/output data from the plant, build a multivariable model of the overall process, simulate the plant's behavior, and control all of the process variables in real time. The online components of DMCplus run on a standalone computer connected to a distributed control system that collects measurements from the plant's sensors and sends control commands to the actuators. DMCplus also uses a linear-programming-based optimizer to identify where setpoints should be in order to run a process most profitably.

Aspen Technology **Circle 269**



Software Departs from Traditional MV Control

Natick, Mass.—Mantra software for multivariable control (MV) provides a graphical programming environment for creating customized control systems on a PC. Designed to be modular and decentralized, Mantra can reside on a DCS module or a PC. Modularity is achieved by interconnecting several single-variable controllers, each with multiple actuators, working to decouple the process so that each process variable can be manipulated independently. Mantra's Modular Multivariable Control algorithm decoupling feature allows the user to establish independent performance criteria for each process variable. Selected process variables can be put on manual control without affecting the performance of the others. **ControlSoft** **Circle 270**

Software for Direct Machine Control

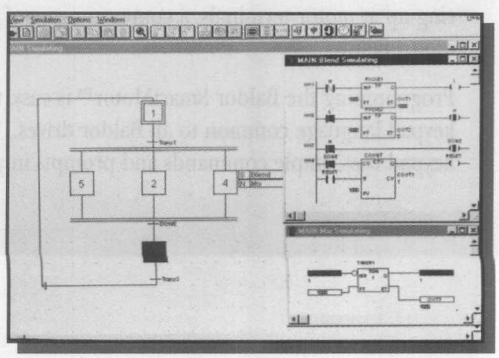
Ann Arbor, Mich.—OpenControl is a 32-bit application that leverages the full range of Microsoft technology to grant enterprise access to the plant floor. Its open architecture allows users to take advantage of flowchart-based logic, real-time deterministic processing speeds, and the convenience of off-the-shelf PC hardware. OpenControl's Hypershare feature allows users to share OpenControl databases with any Windows application or network. It also integrates with all popular SCADA/HMI packages such as InTouch, Paragon, and Citect, or uses Microsoft's Visual Basic. Nemasoft says OpenControl reduces manufacturing costs by lowering control hardware costs, and shortening programming times and machine downtime.



NemaSoft **Circle 271**

Hard Real-Time Control Solution

Naperville, Ill.—Paradym-31, Version 4.0 SoftLogic control software comes embedded with VenturCom's RTX real-time extensions to Microsoft Windows NT. Paradym-31 provides hard real-time, deterministic control capability within Windows NT without the need to run another operating system. It can be applied to all plant-floor control applications up to 100 μsec scan frequencies.



Intellution Inc. (formerly Wizdom Controls) **Circle 274**

Finally, a Controller that Combines a Graphic Operator Interface, Ladder Logic and I/O Connectivity —All in One Device!

Radically cut design and start-up time with our new *GLC 100* Graphic Logic Controller!



You can get the *GLC 100 Graphic Logic Controller* up and running faster than anything else on the market. That's because it includes an industrial controller, a graphic operator touch-screen, software and I/O (or a DeviceNet interface)—all in one package. The assembly and integration work is already done!

The *GLC 100* offers you:

Test and debug time reduction. A single configuration environment reduces engineering, test, and debug time.

Common control and OI database. *GLC 100* creates variable names once. Variable names and function names can be the same.

No serial connection. The *GLC 100* eliminates the integration chores for connecting the operator interface with the controller.

No wiring connection. All necessary wiring is embedded within the *GLC 100*.

The *GLC 100* gives you integrated OI, RISC-based control, ladder logic configuration, plus easy installation and programming.

Set-up is simple. Start-up is simple. Configure the controller and operator interface from a standard PC, and the *GLC 100* operates as a stand-alone control station. You save time, money and aggravation!

TOTAL CONTROL™

An ISO 9001 Company

Innovative Solutions for Automation

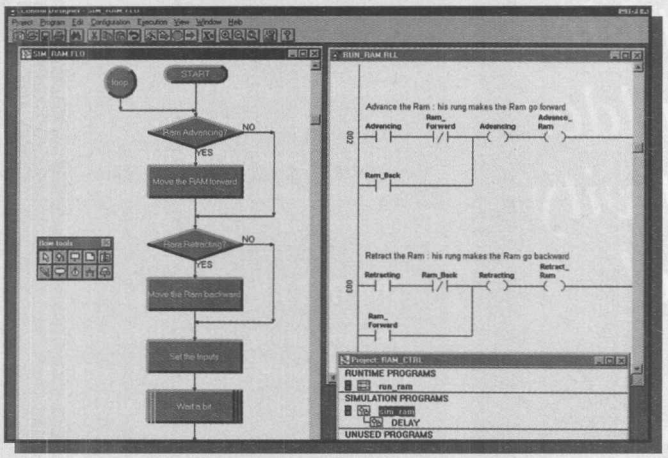


Call for Free Demo CD-ROM

Call 800-265-5154 to get your free demo CD-ROM including complete technical specifications. Find out why the *GLC 100* is right for you!

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Internet: http://www.total-control.com ■ Phone: 708-345-5500 ■ Fax: 708-345-5670

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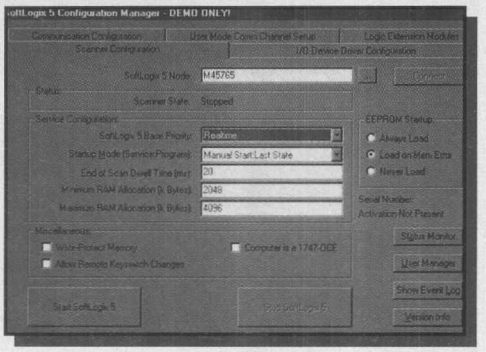


Software Allows Combined Relay Ladder Logic and Flowchart

Ann Arbor, Mich.—Visual Logic Controller (VLC) version 3.0's flowchart programming achieves faster design cycles, lower downtime by using integrated diagnostics, and continuous process improvement not practical with traditional programming languages. With its Ladder Logic capabilities, VLC Version 3.0 provides an easy migration path to flowchart programming. Users are allowed to mix and match ladder logic and flowcharts in a single control project. A ladder logic editor, based on the IEC 1131 standard, allows the use of existing ladder logic programs and combines them with flowcharts. Ladder logic has been enhanced by allowing "action" and "decision" flowchart elements to be used in a VLC ladder program. Two new language constructs, IF-THEN-ELSE and WHILE, have been added and are said to be essential in applications requiring extensive data manipulation and allow more efficient control of the program's operation. VLC can run on Microsoft Windows 3.1 or NT. **Steeplechase Software Inc.** **Circle 273**

PC-based Software Control Engine

Mayfield Heights, O.—SoftLogix 5 is the first member of a new family of software-based control engines. A Microsoft Windows NT 4.0 application, SoftLogix 5 delivers the same control functions as Allen-Bradley's PLC-5 system, but on a PC-compatible platform. It can work with a number of different Rockwell Automation products for programming, human-machine interface, hardware, I/O systems, and networking. SoftLogix can run on either Allen-Bradley's industrial workstations, 1747-OC controller, or any Pentium-class personal computer, and works with Allen-Bradley 1746, 1771, or Flex I/O running on either remote I/O or ODVA's DeviceNet. **Rockwell Automation/Allen-Bradley** **Circle 272**



Product Recognition Awards

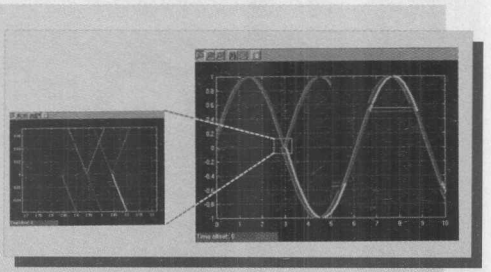


PC-Based Control Package is Multifunctional

Ann Arbor, Mich.—Think & Do PC control software combines flowchart programming, an online debugging facility, and a built-in operator interface into one software control package. Flowchart development follows a top-down approach, and control actions are chosen from a standard menu of control blocks, including discrete operations like TURN ON BIT, and continuous operations like EXECUTE PID CONTROL. The available control blocks cover a broad spectrum of operations required for machine control and process automation. It runs under Microsoft Windows NT on a Pentium 133 MHz processor or better, equipped with 32 Mbyte of RAM and a CD-ROM drive. **Think & Do Software** **Circle 321**

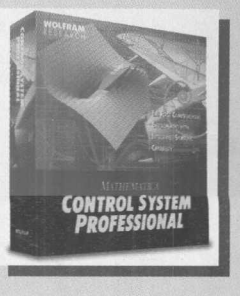
Simulation Software Aids Trial-and-Error Control Designs

Natick, Mass.—Simulink 2.0 provides a graphical environment for modeling and simulating a variety of dynamic systems including linear, nonlinear, discrete-time, continuous-time, hybrid, and conditionally executed systems. Users can create block diagrams of their processes and observe what happens when simulated inputs are applied. Simulink is built upon the MathWorks Matlab technical computing software. Users can choose block diagrams from a standard palette, drag and drop them onto a blank screen, then connect the blocks' inputs and outputs with lines representing the flow of data. Simulink runs with Matlab in a Macintosh or Windows environment. **The MathWorks** **Circle 320**

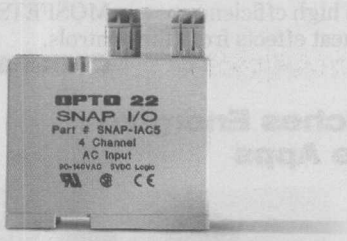


Analytical Tool Produces Numerical, Symbolical Results

Champaign, Ill.—Control System Professional (CSP) solves process control problems by using the notation and terminology control engineers are accustomed to. CSP can handle single-and multivariable control systems in the state space, frequency domain, or the time domain. It includes classical analysis tools, root loci, Nyquist chart, and step response simulations,as well as Kalman filters, and similarity transformations. Users can access these tools either interactively or in batch mode. **Wolfram Research** **Circle 322**



Random failure. The sort of thing that occurs when you rely on random testing.



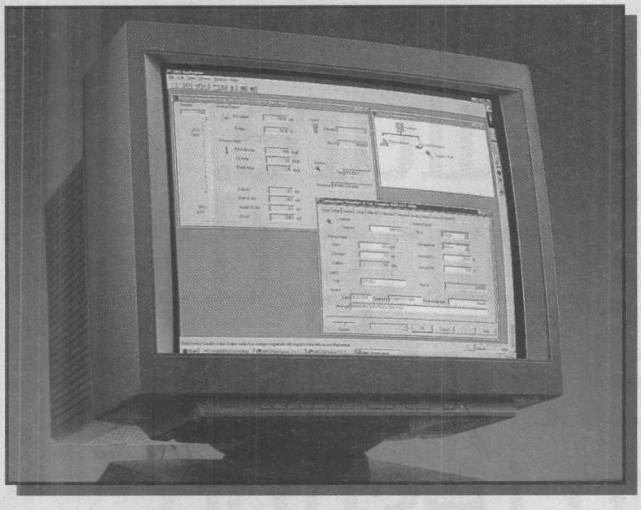
Random testing? What a joke. If yours wasn't the "chosen one" in the batch to be tested, there's absolutely no guarantee it'll work. Or stay working. Fortunately, choosing I/O for your system doesn't have to be a gamble. Every I/O module we manufacture is thoroughly tested. Twice. During final production, and after. So you're ensured of reliable performance that's guaranteed for life. 200% tested I/O from Opto 22. Get ours, or hope you get lucky.

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IT'S AUTOMATIC.

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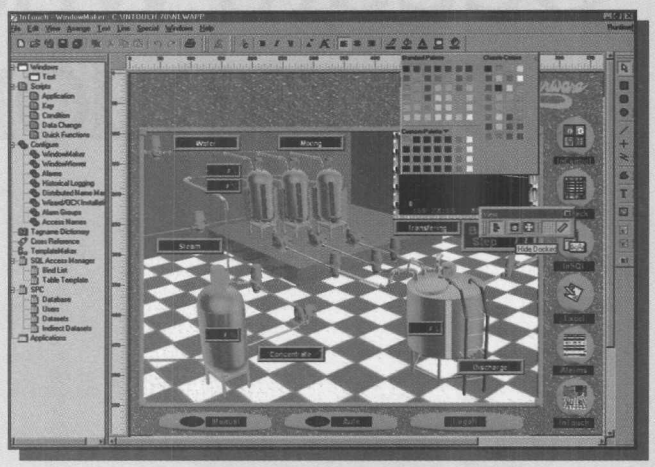


Asset Management has HART ▲

Austin, Tex.—Asset Management Solutions (AMS) takes advantage of two-way field communications (HART) to provide a single platform for integrated data and application management, operator interface, and vendor independent communication support. The AMS Performance software is a family of snap-on modules, such as Field Manager, that works with the Field Server (system interface) to manage plant assets. Typical configurations would include the Field Manager to configure, troubleshoot, and test connected devices, and run with Microsoft Windows 95 or NT workstation, communicating through a HART interchange to HART-enabled devices. **Fisher-Rosemount Systems** **Circle 275**

Software Package Integrates Multiple Application Modules ▼

Irvine, Calif.—FactorySuite software packages integrate seven different Wonderware products for deploying a wide range of manufacturing automation systems. The basic FactorySuite offering provides core technology modules for process visualization, PC-based machine and process control, a real-time plant data manager, Internet/intranet data viewing capabilities, and Wonderware's library of input/output servers to interface to factory equipment. FactorySuite Plus adds application modules for production management and work-in-process tracking, as well as flexible batch management. Both bundles run on the Microsoft Windows NT 4.0 operating system. **Wonderware Corp.** **Circle 323**



MOTORS/MOTION CONTROL

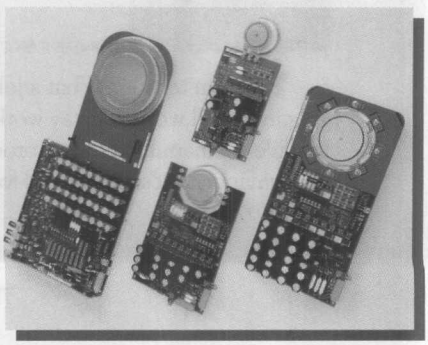
Editors' Choice Awards



Smart Motors Combine Motor-Control Integration

Santa Clara, Calif.—The SmartMotor family of programmable servos for position and velocity control applications combines a brushless dc servo motor with a system controller, amplifier, PLC (for programming and handling embedded functions and peripherals), encoder, and power supplies into one package. SmartMotors' low parts count—25% of typical servo systems—is made possible by the high level of integration. It results in higher reliability and lower manufacturing costs by eliminating cables, connectors, line drivers/receivers, and analog circuitry. A fully digital system with high efficiency power MOSFETS and IGBTs helps hold down heat effects from the controls. **Animatics Corp.** **Circle 340**

MW Power Switches Energize Medium-Voltage Apps



Milwaukee, Wis.—The Integrated Gate-Commutated Thyristor (IGCT) combines the advantages of the thyristor and insulated gate bipolar transistor (IGBT) into one package for efficient power switching up to 10 MW at medium voltages (2.3-6.9 kV). IGCTs improve on the size and complexity of

(continued on p.. 96)

Guaranteed for life. And if our competition says otherwise, we'll open one of these on 'em.



There's a reason we whup the competition. While they rely on random testing, we test every I/O module individually. Twice. Making ours inherently more reliable. They're so reliable, we offer a lifetime guarantee on every unit. Which provides complete peace of mind, knowing the building blocks of your system will stand the test of time. 200% tested I/O modules from Opto 22, guaranteed for life. Put them in your system and kick some serious optically isolated butt.

OPTO 22

IT'S AUTOMATIC.

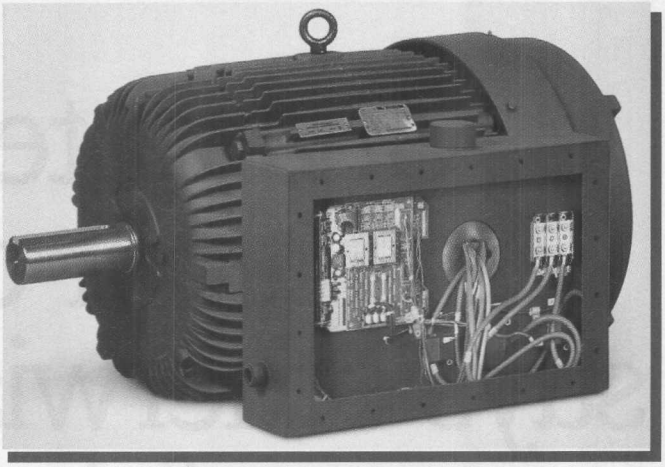
43044 Business Park Drive, Temecula, CA 92590.3614 800.321.OPTO tel: 909.695.3000 fax: 909.695.3095 www.opto22.com

For information circle **58**

GTO (gate turn-off) thyristors, and on the reliability and cost of IGBTs. Advancements cited for the new semiconductors include 50% fewer parts—versus the latest comparable IGBTs—and selectable switching speeds up to 1,000 Hz to suit specific applications. The IGCTs "transparent anode" design permits charges to flow in and out of the device more rapidly. Four levels of packaging are available to designers of medium voltage power control systems. **ABB Semiconductors Circle 339**

Intelligent Monitoring Motors with Predictive Alerts

Cleveland, O.—IQ PreAlert Intelligent Motor can monitor itself in real time by analyzing operating data and identifying potential problems. It uses an onboard integrated system processor and sensors tailored to specific motor applications. The processor and sensors monitor, log, and communicate motor and related process conditions, and consequently analyze up/downstream processes. Users can select parameters for IQ PreAlert's sensors to detect winding and bearing temperature, vibration, and varying load and power conditions. Communication protocols available are RS-232C and DeviceNet. It is offered in 2 through 5 hp (1.5-3.75 kw), 230 or 460 v models. **Rockwell Automation/Reliance Electric Circle 341**

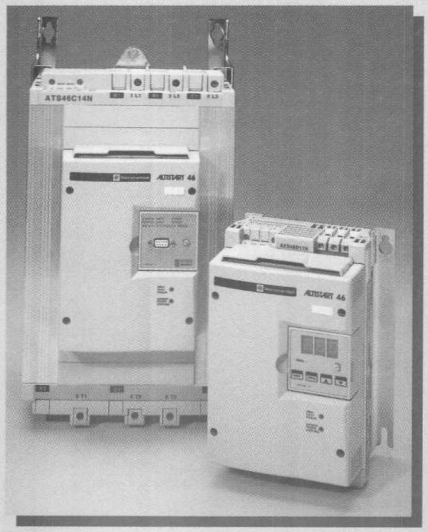


Product Recognition Awards

Series of Mini-Servo Motors

Northbrook, Ill.—Yaskawa Electric America has expanded its product line to include what the company says are the world's smallest ac servo motors. Available in 10 and 20 W models, both come with gear or brake options. A maximum speed of 5,000 rpm can be achieved when used with a high-resolution encoder. Rated torque for the 10 W model is 4.5 oz-in. The 20 W model's rated torque is 9.02 oz-in. **Yaskawa Electric America Circle 344**



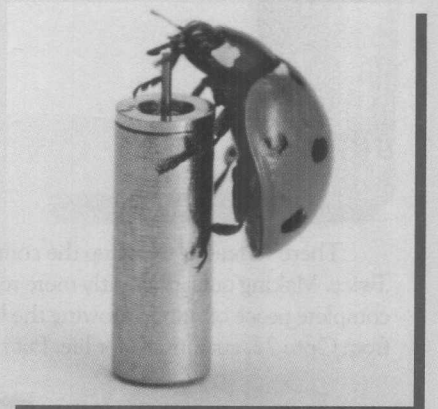


Soft-Start Controller

Raleigh, N.C.—Altistart 46 is said to be the first "soft start" motor starter that bases the acceleration and deceleration ramp on torque rather than current or voltage control. It's designed to provide reduced current and torque for starting squirrel cage motors, as well as deceleration control and solid-state motor protection. Altistart 46 features adjustable overload, digital keypad for accurate setup, and monitoring and serial communications options. Unique to the device are solid-state protection and deceleration options even when a shorting contactor is used to bypass the controller after start up. **Square D Co. Circle 343**

Subminiature Brushless DC Motor

Ringwood, N.J.—RMB Miniature Bearings has developed a 3 mm OD bidirectional brushless dc motor, nicknamed the Smoovy. This permanent magnet motor uses a rare-earth rotor structure, in combination with a three phase slotless stator winding, to achieve what the company says are the lowest eddy current and hysteresis losses possible in a brushless motor. When coupled with two of the company's ball bearings, Smoovy develops 6 milli-oz-in. continuous stall torque and a 7.3 milli-oz-in. peak stall torque at 25 °C ambient temp. **RMB Miniature Bearings Inc. Circle 342**



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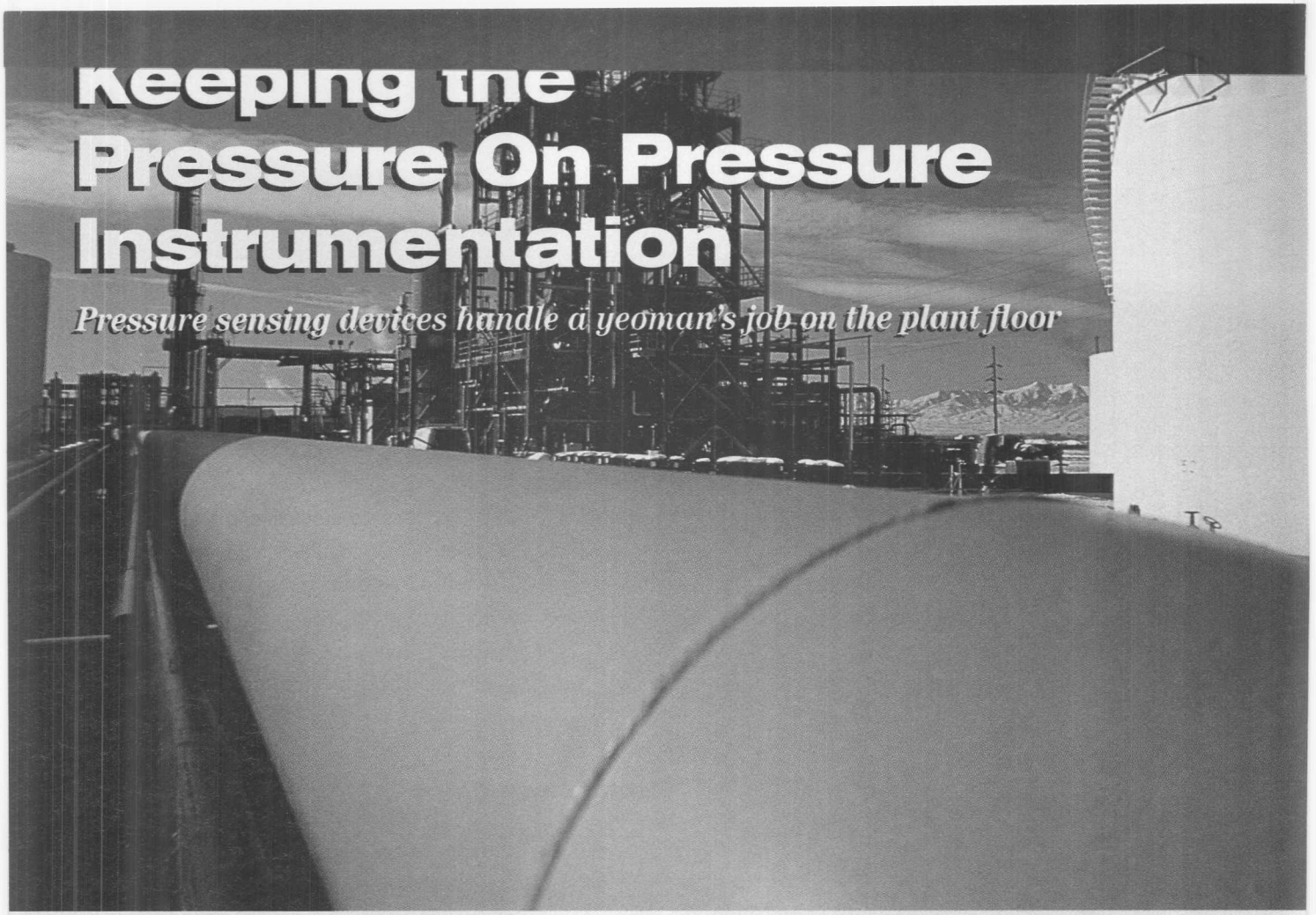
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AD CIG0410

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For information circle **59**



Keeping the Pressure On Pressure Instrumentation

Pressure sensing devices handle a yeoman's job on the plant floor

Dick Johnson,
CONTROL ENGINEERING

This is the first installment of a five-part series on Process Sensing. Smart sensors will appear in May. Others include temperature sensing (June), flow measurement (September), and level sensing (November).

Temperature may be the most measured process variable, but pressure sensing devices may be the most ubiquitous. These instruments, besides their intended pressure measurement duties, get "into the act" on flow and level measurement. A large process plant may require thousands of these hardworking instruments to keep processes under control.

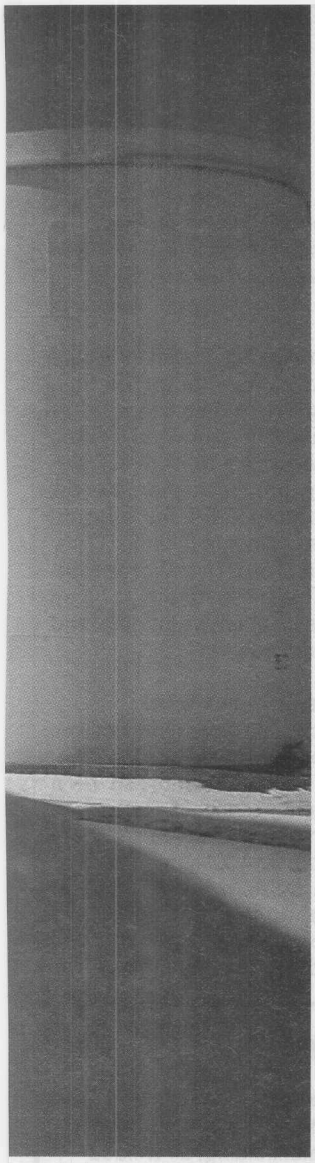
The fact that pressure sensing devices must penetrate the process to do their job only complicates matters. Hazardous materials often make up the process media being monitored. If these materials are corrosive, they shorten instrument life and raise associated maintenance costs. They can also add to a plant's fugitive emission burden. Therefore, minimizing potential leak sites in these widespread devices is a requisite for good instrument design. (See accompanying sidebar).

Overall, pressure instrumentation design has kept up with demands. Yokogawa Industrial Automation (YIA, Newnan, Ga.) now offers the A-Series DPharp digital pressure transmitter that is said to offer a 40% improvement in general specification for ambient temperature and static pressure effects. The device (available in eight models) meets a 3-sigma conformance criteria on every model. On dp models, reference accuracy in rated at 0.075% of span plus 0.02% of URL per 50 °F temperature change. Long term stability is 2± 0.01% per a 24-month period.

In the real-world example, YIA's DPharp device is used to accurately control the steam/water interface in utility boiler drums. Fluctuating pressures within the boiler during startup and shutdown (times when level is most critical) require the device's stability in the face of pressure effects if accurate level is to be maintained. The silicon sensor's hysteresis-free capsule design also provides protection against overpressure conditions (and subsequent calibration requirements) that can occur during operation.

Under pressure

Ceramic sensors, known for corrosion and wear resistance, also provide excellent measurement stability and protect against process overpressure. Endress + Hauser (Greenwood, Ind.) now offers the compactly designed Cerabar T ceram-



Pressure instrumentation is "at home" in multiple applications (pressure, dp, flow, and level) in large process plants. Courtesy: Opto 22/Flying J Photos

ic-sensor-based pressure measurement system with its sensor line that leverages these features. The device, which withstands up to 100 times overpressure, is said to have virtually no maintenance requirements, is easy to install, and requires no calibration.

Adaptable to a wide range of industrial application, the Cerabar T can be used for absolute or gage pressure in gases, steam, liquids, or vapors. The transmitter has a measuring range of up to 580 psi at temperature ranges from –4 to 185 °F (–20 to 85 °C). Overall accuracy is 0.5%. Chosen for its ceramic sensor specifications and competitive price ($175 ea.), a current application is in marine and stationary diesel engines manufactured by a European-based OEM.

High overpressure capability at high temperatures is also a feature of Omega Engineering's (Stamford, Conn.) PX82 Series wet/wet dp transmitters. The device, which can measure inches of water at line pressures up to 1,500 psi, has found application in flow situations where the pressure drop across inline filters must be closely monitored.

The device is FM/CSA approved and intrinsically safe. FM hazardous location capability is optional. Fabricated from stainless steel and Inconel for use in harsh environments, the transmitter provides a 4-20 mA output.

Taking the heat

Exposure to high temperatures can be troublesome for many pressure sensors. To overcome this problem, ABB Instrumentation (Rochester, N.Y.) developed the 614P remote-seal gage pressure transmitter specifically for use in extruders and homogenizers. The device's process diaphragm is made of a series of convoluted rings, similar to those used on nonremote seal isolation diaphragms for industrial transmitters. The convolutions are said to provide the flexibility necessary to increase performance, reliability, and instrument life while reducing drift in the face of elevated temperatures.

The 614P, which is "HART Smart" and withstands temperatures—up to 645 °F (340 °C)—found in equipment such as extruders and homogenizers, has minimum and maximum spans of 500 and 6,000 psi. The 614P is currently used in a plastic-fiber extruder line to control premature failure and unacceptable drift, caused by wide temperature changes experienced in everyday operations.

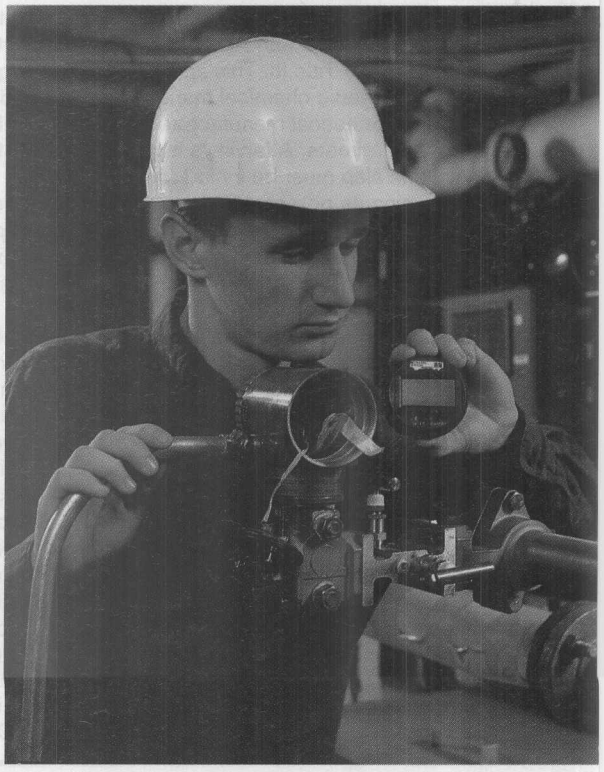
Standing up to high temperature during the pressure sensing process is also the forte of Honeywell IAC's (Phoenix, Ariz.) Smart Gauge Pressure Temperature for High Temperature. True to its name, the device withstands higher process temperatures than Honeywell's standard product (150 vs. 110 °C). which allows the elimination of remote seals and filled capillary systems for many applications. Key uses include applications which must comply with strict sanitary requirements, such as ice cream manufacture.

Because of its raised operating temperature spec, the transmitter can now survive overtemperature conditions caused by steaming instrument lines after a "freeze." Additionally, because the process equipment must be cleaned regularly with steam and a caustic solution, elimination of remote seals and filled capillary systems speeds the cleaning process, thus lowering sanitation costs.

Following the digital path

The original I/A Series pressure transmitters were introduced by The Foxboro Co., (Foxboro, Mass.) in October 1987. The device, designed with a field-swappable electronics module (either basic 4-20 mA or Foxcom digital), can incorporate either newly introduced enhanced analog or HART (Highway Addressable Remote Transducer) communication modules. According to the company, a Foundation fieldbus module will soon be available.

This innovation provides smooth migration from analog to digital communication during a control system upgrade, allowing original plumbing and hardware to remain in place. The flexibility preserves much of the original hardware investment. Additionally, reranging capabilities



A technician swaps the electronics module on a Foxboro I/A Series pressure transmitter in the field to upgrade it from 4-20 mA to digital communications. Courtesy: Tom Croke/Visual Images

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KEY WORDS

- Process control & instrumentation
- Pressure sensing/ measurement
- Transmitters

40% of all pressure transmitters are used with instrument manifolds

(previously only in the domain of digital communication) are now available in the enhanced analog electronics. Users can now adapt to changing process pressure requirements, using its built-in display and keypad to rerange in the field. Because an analog transmitter can now be reranged to meet different process applications, users can reduce spare parts inventories.

Controlling installed costs

Approximately 40% of all pressure transmitters are used in conjunction with instrument manifolds. These manifolds are used to block off the process during start-up, to isolate the transmitter when calibrating or testing, and to allow removal of the device without having to shut down the process. To help control both installation and hardware costs, the recently introduced Fisher-Rosemount (Eden Prairie, Minn.) Model 3051 Coplanar pressure transmitter integrates manifold functionality directly into the transmitter itself.

The integrated device now arrives at the job site fully assembled, seal tested, and calibrated,



Environmentally sealed pressure transmitters, such as Sor Inc's 530 Series, have found an application niche with the off-shore oil industry.

greatly simplifying installation and speeding commissioning. The unit, which weighs less than 8 lb (3.5 kg) can be directly mounted to the process. According to its developer, eliminating brackets, pipe stands, impulse piping, and installation labor can save as much as $150 per installation. Its integral transmitter/manifold construction also helps users meet environmental and safety regulations.

Look ma, no hands!

Keeping track of handheld devices needed for instrumentation configuration or calibration can be a real headache, especially on a large plant site. Sitrans P pressure transmitter from Siemens Energy & Automation (Alpharetta, Ga.) addresses the problem by allowing instrument configuration via pushbuttons located on the unit. It is also remotely configurable via the HART protocol. According to its manufacturer,

Try a Little Friendliness—Environmental Friendliness, That Is

Monitoring of fugitive emissions is required by the maximum achievable control technology (MACT) standards under Clean Air Act Amendments (CAAA) Title III. This applies to synthetic organic chemical manufacturers, pharmaceutical manufacturers, and petroleum refiners. A facility's fugitive emissions also must be included when determining its potential to emit hazardous air pollutants under CAAA Title III and V. However, the U.S. Environmental Protection Agency has been known to waive some measurement requirements if satisfied with a process' containment measures.

Increasing instrument accuracy, while pushing design and materials limits, has enabled manufacturers to help users minimize point emissions, process waste, and nonpoint (fugitive) emissions. High-accuracy instrumentation allows operators to run processes as near to optimum as possible, accurately controlling energy requirements and subsequent stack emissions. Close process control also eliminates out-of-spec product or waste that can lead to disposal problems and related concerns.

In the case of Honeywell IAC's ST 3000 and SMV 3000 DCS products, digital integration with their DE protocol control systems offers real-time, online diagnostics and error checking that are said to improve reading reliability and confidence in measurements sent to the control room. According to a spokesperson for Honeywell, a high degree of confidence in field signals allows operators to "push" the plant harder and closer to design limits, resulting in higher efficiencies with less pollution and waste.

Help from the design

Removing potential leak sites can also eliminate fugitive emissions. In the case of pressure transmitters, drain vent valves are used to purge gases' or liquids' error-causing buildup in the flanges and impulse lines materials. Also, the valves vent product to atmosphere prior to calibration or removal of the instrument from the process. With the Fisher-Rosemount's Model 3051 Coplanar device, these drain vent valves are replaced with controller vent ports which allow capture of all vented product into collection lines.

Design of instrumentation to eliminate potential "plumbing" leak points also helps to eliminate nonpoint emissions. Use of integral manifolding, all-welded gasketless connections, and transmitter designs that eliminate the need for dp equalization 3-valve manifolds similar to the design used in Yokogawa Industrial Automation's DPharp pressure transmitter line offer this solution.

Finally, use of engineered gasket materials offer additional help in controlling nonpoint toxic releases. For example, Foxboro uses Teflon as standard gasket material in its I/A Series dp pressure transmitters. This material provides superior corrosion resistance across virtually all process applications, minimizing the chance of gasket breakdown and resulting toxic releases. In most cases, pressure instrumentation makers now allow users to specify gasket materials that meet process requirements.

As pressure instrumentation design evolves, manufacturers continue to meet pollution challanges through innovative design. Even in a situation where sheer numbers are *not* in its favor, these devices have shown they can "keep a lid on it."

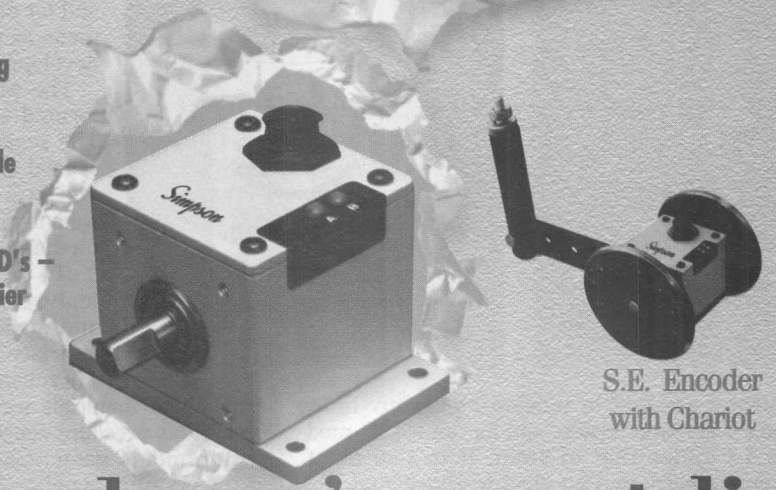
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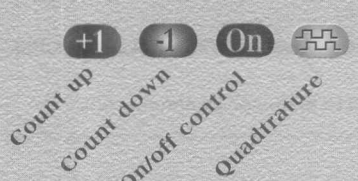
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The Sitrans P, which is one of the most stable devices available, can measure pressure between 0.4 in. H_2O and 5,800 psi. The device can be used to measure differential, gage, and absolute pressure, as well as flow and level.

Protecting the bridge

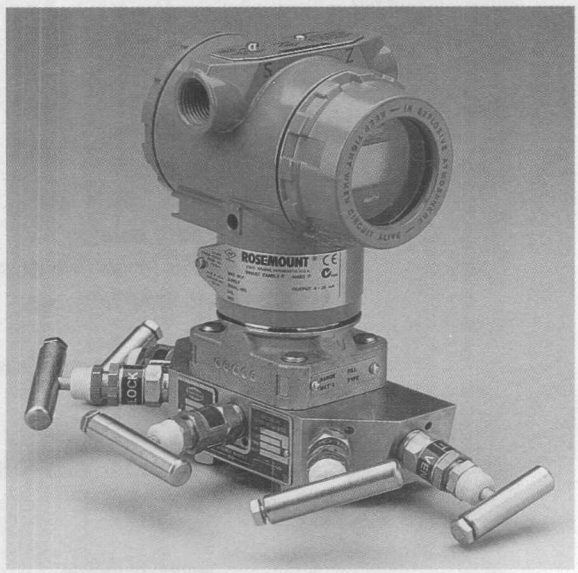
SOR Inc's (Lenexa, Kan.) S530 Series Mini Hermet is an environmentally sealed, analog-based pressure transmitter. The device uses alumina-based (Al_2O_3) ceramic sensor technology. Alumina is almost perfectly elastic within its load range, as strong as steel in tension and many times stronger in compression, and has an elastic modulus 1.6 times that of steel. It is also inert, extremely hard, and an electrical insulator. The device's strain gage bridge is fired into the ceramic diaphragm at 1,000 °C, ensuring linearity and stability, necessitating fewer calibrations than standard analog devices.

530 Series devices are field adjustable using external, magnetically coupled adjustments, and are designed for use in explosion proof and intrinsically safe operations. The units are serialized for traceability and handle pressures from 10 to 2,000 psi, with agency approvals from FM, CSA, and CENELEC.

Turning it on (or off)

PN7 Series analog pressure sensors developed by "efector inc" (Exton, Pa.) incorporate microprocessor-based electronics in a rugged compact housing. This series of sensors is field programmable and requires no bench calibration, substantially reducing installation cost. The switch features 4-20 mA output, single switch setpoint, and a 3-digit LED display. There are two independent switches in each housing, allowing the device to handle applications that require two independent output with adjustable hysteresis. One unit can replace a gage, transmitter, and switch. Pressure ranges of 30 to 6,000 psi are available.

PN7s have been used by the paper industry to detect clogged starch filters by monitoring pressure on either side of filter screens. As the screens clog, restricted flow raises the differential pressure (dp). The two analog outputs are sent to a PLC to determine the dp. When the specified dp is reached, flow is diverted to a parallel line and the switch output is used to signal a local high-pressure alarm. The device's display verifies functionality.





(left) Model 3051 Coplanar from Fisher-Rosemount features integrated manifold functionality resulting in less parts, labor, and expense per installation.

(right) Conventional transmitters exposed to overpressure can lose accuracy due to diaphragm deformation. Endress + Hauser's Cerabar T transmitter combats this with a ceramic sensor, resistant to overpressures 800 times its measuring range.

Silicon-based accuracy

MT10 Mini-manometer from Yokogawa Corp. of America (Newnan, Ga.) is a high-reliability, high-accuracy instrument. Small and lightweight, the device is suitable for use at a process site and for diagnosing factory equipment, as well as for research and development.

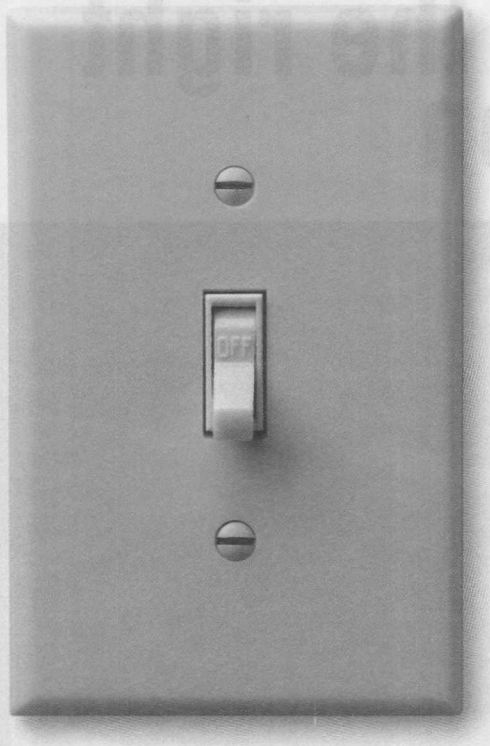
The MT10 employs a microformed silicon-resonant sensor. The sensor, which uses a single-crystal silicon resonator embedded in a silicon diaphragm, is said to provide ultrastable performance with an accuracy of 0.01% of reading. The device features a data-hold function and an RS-232 communication interface.

Evolving technologies in both sensor and materials technology have kept the ubiquitous pressure sensor ahead of the process requirements game. Can it continue? As long as the pressure is on! □

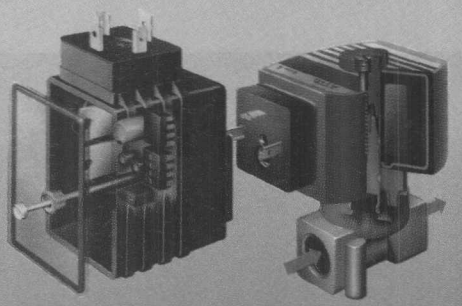
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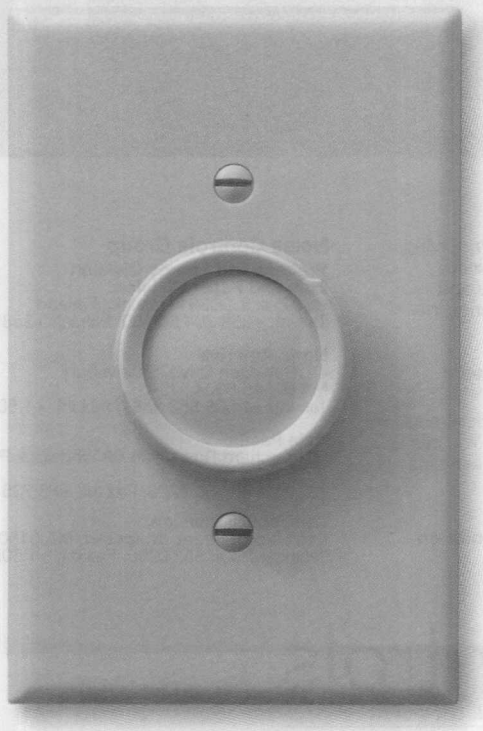
The design also includes a unique core with two Dupont Teflon rider ring guides for long life and low maintenance.

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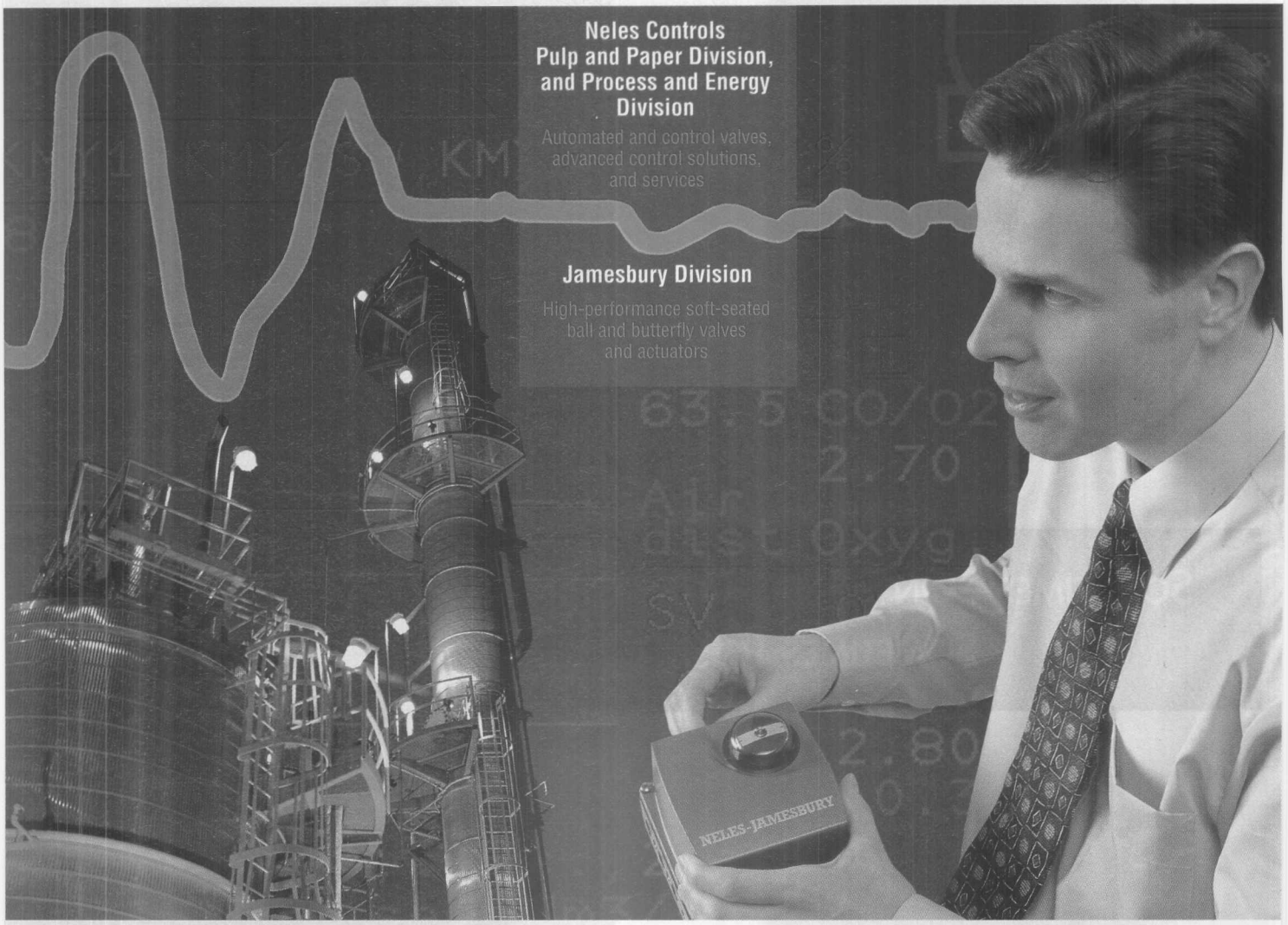
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For information circle **62**

Gaining Control with SPC Software

With proper tools, statistical processs control software can be used to understand a process, minimize variation, and continue improvement.

Hank Hogan, Contributing Editor

Charting the progress of statistical process and statistical quality control (SPC/SQC) shows a definite trend. It's straight up.

However, the latest software promises to tame the charting beast. Vendors are integrating their wares more completely with supervisory control and data acquisition (SCADA) systems, targeting their products at audiences other than quality engineers, and opening programs up for easier data import and export.

These trends are evident in stand alone SPC packages from such vendors as Applied Statistics Inc. (St. Paul, Minn.), SAS Institute Inc. (Cary, N.C.), and SPSS Inc. (Chicago, Ill.). The same can be said for modules from such human-machine interface (HMI) suppliers as Intellution Inc. (Norwood, Mass.), National Instruments Corp. (Austin, Tex.), TA Engineering Co. Inc. (Moraga, Calif.), USDATA Corp. (Richardson, Tex.), and Wonderware Corp. (Irvine, Calif.).

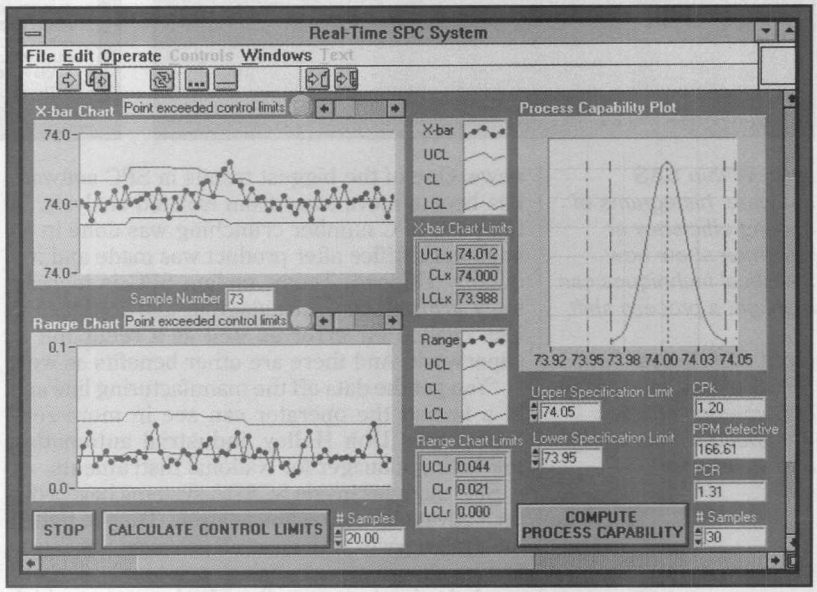
Covering the basics

There are differences between the various programs, although most will meet basic SPC needs. All produce such standard SPC charts as X-bar/R and its various cousins. All but the module from TA Engineering also offer Pareto analysis and process capability statistics such as Cp and Cpk. The same group has run-time rules, such as raising a flag when x number of samples in a row have been high or low. In general the stand-alone versions offer more power than the modules do, although most will satisfy basic requirements. TA Engineering plans to partner with a software company to offer an integrated and more complete SPC solution. This partnership should be in place by second-quarter 1998.

One thing no SPC package can do is magically create expertise in statistical process control where none exists. Nor can software wrestle an unruly process into submission. That's why it's best to make sure the process knowledge basics are covered before any SPC software purchase.

"A first question [to answer] before people go and get SPC software is do they need and can they get SPC, period," says Lonnie Wilson, founder of Quality Consultants (El Paso, Tex.) See sidebar, "How to Get Started with SPC."

For those already underway, there is welcome



National Instruments calls LabView SPC Tookit a virtual instrumentation library for statistical process control applications.

SOME SPC TERMS

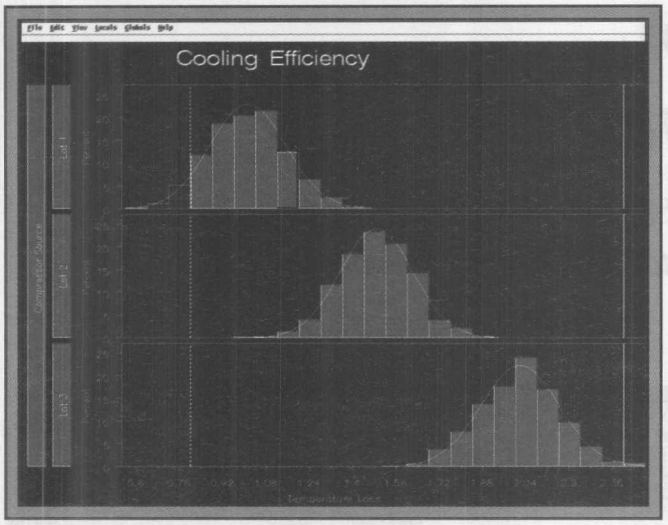
- **Cp:** Process capability calculated by Tolerance/(6 sigma). Only measures dispersion.
- **Cpk:** Process capability calculated by the smaller of (Mean-Upper Spec)/(3 sigma) or (Mean-Lower Spec)/(3 sigma). It measures both dispersion and central tendency. A 6 sigma program implies Cpk of 2 or greater.
- **EWMA chart:** Exponential Weighted Moving Average. It detects small recent variations by assigning an exponentially declining weight to data points as they age.
- **Pareto chart:** A means of classifying problems from important few to trivially many. Defects are assigned a cause and categories ranked in order of number. The most significant problem will be the first.
- **Run rules:** Guidelines to detect nonrandom process shifts. Some rules use six or nine data points on one side of the mean in a row. They are based on the likelihood that so many successive readings will not occur randomly.
- **X bar, R:** This most popular of Shewart charts plots average (X bar) and range (R) for a sample.

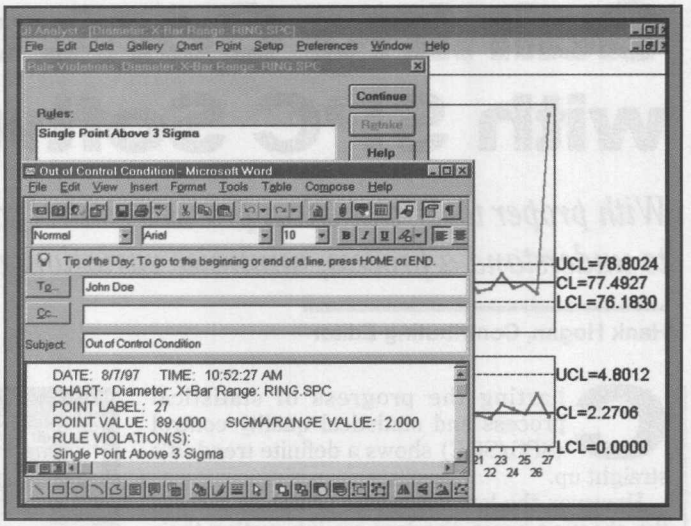
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KEY WORDS



- Software for control
- Statistical process control (SPC) and Statistical quality control (SQC)
- Human-machine interface software
- Supervisory control and data acquisition
- Quality assurance





Left: Within SAS software, histograms of cooling efficiency at Coleman show how statistical techniques can highlight a process shift.

Right: QI Analyst from SPSS allows monitoring of numerous charts. Enhanced alarms clarify rule violations.

news. One of the biggest trends in SPC software has been a move away from isolated analysis. In the past, SPC number crunching was done in an engineer's office after product was made and frequently shipped. Today, on-line SPC is increasingly favored. One advantage to this approach is less chance for error as well as a reduction in paperwork. And there are other benefits as well.

"You get the data off the manufacturing line and in a format the operator can see in more real-time," says Don Holley, industrial automation marketing manager for National Instruments.

SPC modules inside SCADA systems have a distinct advantage for on-line analysis. They're tightly integrated parts of the overall package. Since control points are already being monitored, all that's needed to implement on-line SPC is to set up which points to include in the statistics. There's only the HMI interface to contend with, making configuration and training relatively easy. The same tight integration also makes it simple to set up alarm conditions and should eventually lead to SPC being an active part of the process control loop.

The trend toward modules is so strong that HMI industry giant Rockwell Software Inc. (West Allis, Wis.) is in beta test with an integrated SPC module for its RSView product. It is based on work done earlier with sister company Datamyte Business (Minnetonka, Minn.). The older project was scrapped in favor of an internal Rockwell development. The new module is due for release second-quarter 1998.

As another indicator of this trend, Charley Rastle, vice president of system integrator Process Analysts Inc. (Lakewood, Colo.), reports that the last three quality systems his company installed have all been migrations from stand-alone packages to modules from HMI vendors.

Off-line isn't out of line

Stand-alone vendors are combating this by adding alarms to their products so that they too can be part of the overall control loop. As a result these programs operate under special constraints.

"It is critical for an SPC program to be flexible enough to work with a variety of gages and also have the capability to import data from a number of different data sources," comments Courtney Hye, manager of the Quality Products Marketing Group in the Quality and Manufacturing Business Area of SPSS.

QI Analyst from SPSS can, for example, gather

How to Get Started with SPC

For those who've decided to implement SPC, software can be a "Jekyll and Hyde" situation. The right software will make things easier while the wrong will do just the opposite.

"Software that is too difficult to use will not be used correctly or at all," warns Sophronia W. Ward, a statistician affiliated with Statistical Process Controls Inc. in Knoxville, Tenn.

"The most important thing that a user should do is to define the software need carefully and who will be the user of the software."

It's important to make sure that the software satisfies the requirements behind any SPC system.

If SPC is being implemented because of a customer requirement or government regulation then whatever software is selected has to satisfy that demand.

Beyond that to be successful the software should:

- Allow easy data entry;
- Analyze the data correctly; and
- Integrate the necessary tools to build knowledge about the process.

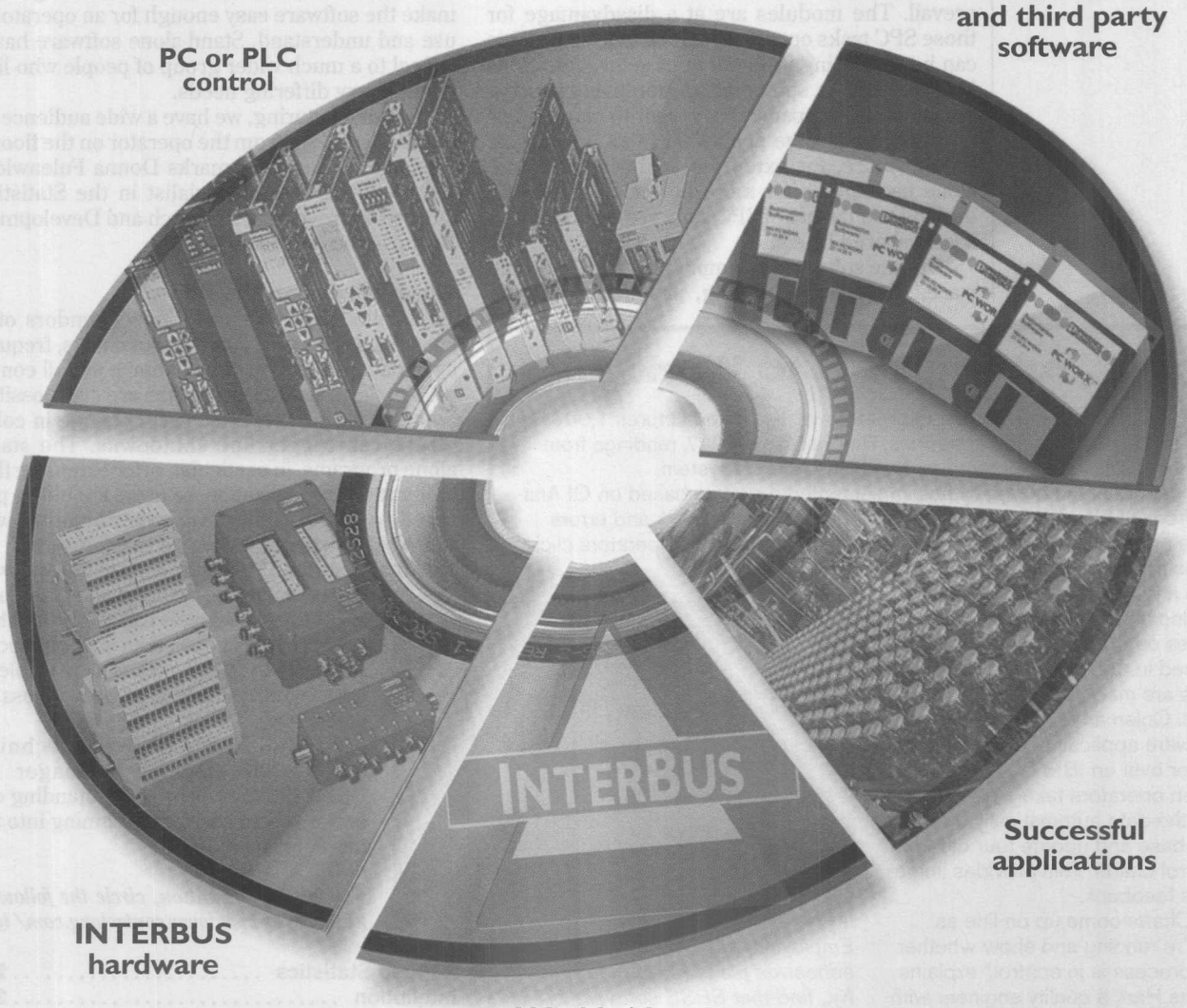
Furthermore, easy data entry should include some means for automating the process. While correct analysis should be a given, calculations should be checked.

The last point is an important one. With the proper tools SPC can be used to understand a process, minimize variation, and become a means for continuous improvement. However, no program can take the place of a capable control engineer.

As Ms. Ward notes, "Software does not improve processes, people do."

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INNOVATION IN INTERFACE

*Device Network and Fieldbus Worldwide Outlook, Automation Research Corp., Dedham, MA, January '97

For information circle 63

HMI and control software vendors integrate SPC/SQC modules

data nine ways, ranging from reading ASCII files to importing spreadsheets, to handling direct input from devices. Offerings from the SAS Institute and Applied Statistics are just as adaptable. For the future, the ongoing development of open data exchange standards should make this task easier. However, the days of free-wheeling mix and match is still a few years off.

It could also be that both sides of the debate will prevail. The modules are at a disadvantage for those SPC tasks outside of a SCADA system. This can be a pressing problem in large organizations because SPC is spreading to nonmanufacturing areas. Some companies may want to standardize on a single package applicable to all operations. Furthermore, for extensive analysis the stand-alone packages offer more power. So it may be that the two flavors of SPC software will coexist—a view shared by some.

"Off-line software is complimentary to our software," declares John Eng, product marketing manager for SPC Pro from Wonderware. Mr. Eng won't divulge the exact number of users for SPC Pro, but he admits it is far fewer than the 70,000 Wonderware InTouch HMI users.

One result of this spread of SPC to the factory floor and beyond is that the programs are being used by a wide variety of people. Very few of them are quality engineers or statisticians. For the modules from HMI vendors the challenge is to make the software easy enough for an operator to use and understand. Stand-alone software has to appeal to a much wider group of people who likely have very differing needs.

"In manufacturing, we have a wide audience for our SPC software from the operator on the floor to the plant manager," remarks Donna Fulenwider, technical marketing specialist in the Statistical Quality Improvement Research and Development Group at the SAS Institute.

Customization fits all

To handle this spectrum of users vendors offer customization tools. The types of charts, frequency of data points, and control limits are all configurable. Several different alarms are also possible. Some of the simpler ones use a change in color; others can trigger line shutdowns. The stand-alone programs, in particular, offer extensive flexibility and personalization, so users should be prepared to spend some time experimenting with these options to get full use of the software.

A final trend for SPC designers is to move toward an easy interface with outside programs. All of these packages can talk to databases that support open data base connectivity (ODBC). That makes it possible to both export and import data across an enterprise.

As Bob Reed, strategic technical account development manager for USDATA, says, "The understanding of a better way to use data is coming into the marketplace today." □

For more information, circle the following numbers or visit www.controleng.com/ info:

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Rockwell Software 203
SAS Institute 204
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Statistical Process Controls 206
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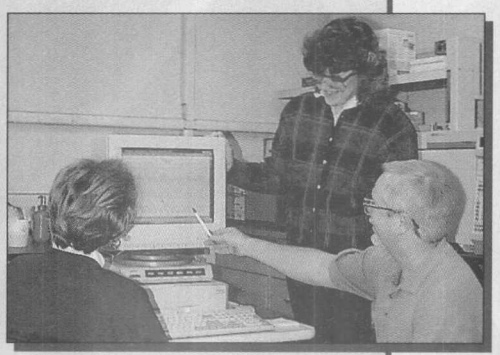
Putting SPC to Work

The Dow Corning plant in Elizabethtown, Ky., manufactures 1,000 different sealants and adhesives. Before March 1997, readings from those products were entered by hand into an SPC system.

Since then, the company has implemented a system based on QI Analyst from SPSS. The new software cut down on paperwork and errors while providing visual feedback for out-of-control points. Operators click on points to enter discrepancy explanations.

In another application, Coleman Co. Inc.'s plant in Wichita, Kan., makes outdoor camping gear. SPC is used in the press shop, where parts are made from large rolls of steel. Coleman runs an SAS software application on a real-time server over an IBM OS/2 network. When operators take a gage reading, the data automatically enter the database and update four different control charts. This provides immediate feedback.

"Charts come up on-line as they're running and show whether the process is in control," explains Dallas Hart, a quality engineer with Coleman.



Employees at a Dow Corning adhesives plant in Elizabethtown, Ky., find that SPSS software reduces keystrokes and errors, compared to previous methods.

Alarms to prediction

The Aluminum Co. of America (Alcoa) plant near Yankeetown, Ind., produces more than 300,000 tons of aluminum a year.

Prior to going into everything from cans to venetian blinds, the metal first has to go through a smelter. During the smelting process metal is checked for weight and thickness. With software now in use, an alarm automatically sounds when an SPC error occurs.

Under a partnering agreement with Rockwell Software (West Allis, Wis.), Alcoa looks ahead to more aggressive process control. According to Joseph Motz, a staff electrical engineer at Alcoa, the new software will also allow on-line SPC because of the benefits this brings.

Mr. Motz says, "We can react before it's too late. We can proactively react."

Hannover Fair '98 Goes More Global Than Ever

Leading products, technology solutions, and vital business opportunities await the 300,000-plus visitors to this April 20-25 show. And more of the visitors and exhibitors are international.

Frank J. Bartos, *CONTROL ENGINEERING*

Start the second 50 years! Hannover Industrial Fair begins its second half-century after a long, successful run that began under quite humble circumstances. This "world's largest industrial trade fair" arose from the post-World War II ravages of Germany.

As Hannover Fair faces its second half century, more changes are certain due to economic and technology trends. But the fair's role to span all branches of industry and identify important technology trends will remain. Also part of that role is to "serve as a platform for economic and technology policies, promote marketing strategies on a global scale, and be a focal point for industrial and communication networks," says show organizer Deutsche Messe AG (DMAG).

Today and tomorrow

Dr. Klaus E. Goehrmann, chairman of DMAG's board of management, told *Control Engineering* that during the next few years, the fair intends to continue a focus on today's "many and varied political implications," while forecasting future industrial developments. "Innovation, technology, and small- and medium-sized business are just some of the key words. Forums will examine exemplary projects which can then be evaluated in terms of their practical application [in future fairs]," he says. For example, microelectronics and information technologies are trends now in the forefront to streamline production processes.

Dr. Goehrmann goes on to explain another aspect of the show, "Hannover Fair has a profound influence on the marketing activities of exhibiting companies and potential buyers alike." It often translates into increased efforts for global and international projects.

And this is evident in the fair's growing international content. Roughly half of the 7,000 exhibitors (representing 69 countries) and almost 25% of the 300,000-plus expected visitors will come from 100 countries outside Germany.

Decision makers increasingly comprise a high percentage of the visitors (90% last year).

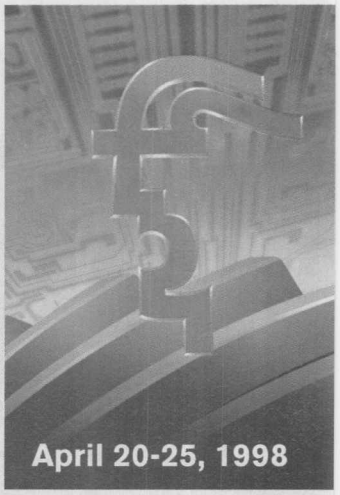
Major arenas

In keeping with the fair's recent format, *Electric Automation* carries the leading role in odd-numbered years. Still, this sector is well-embedded into other technologies in *any* year. Three major areas are the focus in 1998:

- *Materials Handling & Logistics*—Halls 19-26 and an open air site, with about 950 exhibitors and nearly 1 million ft² of displays. Highlights for control engineers will include control systems for materials handling, "driverless transport" systems/com-



It's not just machinery in the Robotics & Automation sector. Special displays will include a "Sensorics Center" and "Microworld" to demonstrate opportunities and benefits of microtechnology.



HANNOVER MESSE '98

The Fair at a Glance

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←For information cricle **64**

equipment and information systems viewpoint.

- *Robotics & Automation*—Halls 14-17, with 850 exhibitors and 280,000 ft² of space. This prime interest sector for *Control Engineering*'s audience carries the theme of "Production Automation," illustrating the shift from isolated (island) solutions toward integrated automation solutions. Besides the latest in robot technology, displays will focus on industrial communications plus related bus and network systems; sensors and remote control technology; computers; simulation; and software.
- *Surface Treatment*—Halls 4 and 5, showcasing 450 exhibitors on 150,000 ft² of space. Emphasis will be on surface coating processes from pre- to post-treatment. Special presentations, such as "Plasmaworld," "Galvanoland," and "Thin Coatings" will cover specific treatment methodologies.



Modernistic Hall 26, built in 1996, is one of several venues for Materials Handling and Logistics exhibits.

Fairs within a fair

Still other venues make up this "Fair of Fairs:"

Energy and Environmental Technology (Halls 11-13 and an open air site; 1,350 exhibitors) will display a gamut of equipment and products for energy generation, distribution, and energy-related environmental technology. Hall 13, new in 1998, will house the technology of Renewable Energy Sources.

Production Equipment for Electrical Engineering and Electronics (Hall 7, 140 exhibitors) will focus on all phases of production as well as products, systems, and full installations.

Lighting Technology—Halls 8-10, 450 exhibitors.

Research and Technology—Hall 18, 650 exhibitors.

Continuing a Hannover Fair tradition, a "Partner Country" is selected each year to profile its industrial capabilities and business infrastructure. This year, the honor goes to the Republic of the Philippines (Hall 4). Some prior honorees included Britain in 1997, the U.S. in 1996, and Hungary in 1994.

A wide array of special displays, forums, congresses, and panel discussions rounds out the fair's information content for visitors.

Sampling the participants

Hannover Fair is a venue for companies large and small. One of the largest perennial exhibitors, **ABB** (Asea Brown Boveri), will carry the theme of "Energy and Environmental Technology" this year. In particular, ABB Business Area, Automation & Drives, plans to introduce a new ac minidrive and enhancements to its seasoned Open Control System (Advant OCS) for OEMs and end-users. Industrial products for markets in the U.S. are vested in **ABB Industrial Systems** (Columbus, O.).

Walkee, Wis.) main stand will be an automation theater, presenting three shows per hour throughout the fair: Automation World, Open Automation, and Motor Management. A full product range—from systems to components and software—will be on exhibit. Don Davis, Rockwell International president and ceo, and Jodie Glore, president and ceo of Rockwell Automation, are slated to attend.

Siemens (Munich, Germany), another giant exhibitor intends to profile its breadth of capabilities with Power Transmission and Distribution, Production and Logistic Systems, Automation & Drives (A&D), and Systems Engineering among exhibiting groups. The A&D group's two stands will highlight system integration for the fieldbus sector, plus new products for controls and drives, industrial communications, and human-machine interfaces (Hall 16); and low-voltage distribution and electrical installation equipment in Hall 11.

Communication and bus networks find an active role on the industrial scene. This is reflected in growing exhibits for associations such as **Profibus Users Organization, Interbus Club,** and **CAN in Automation.**

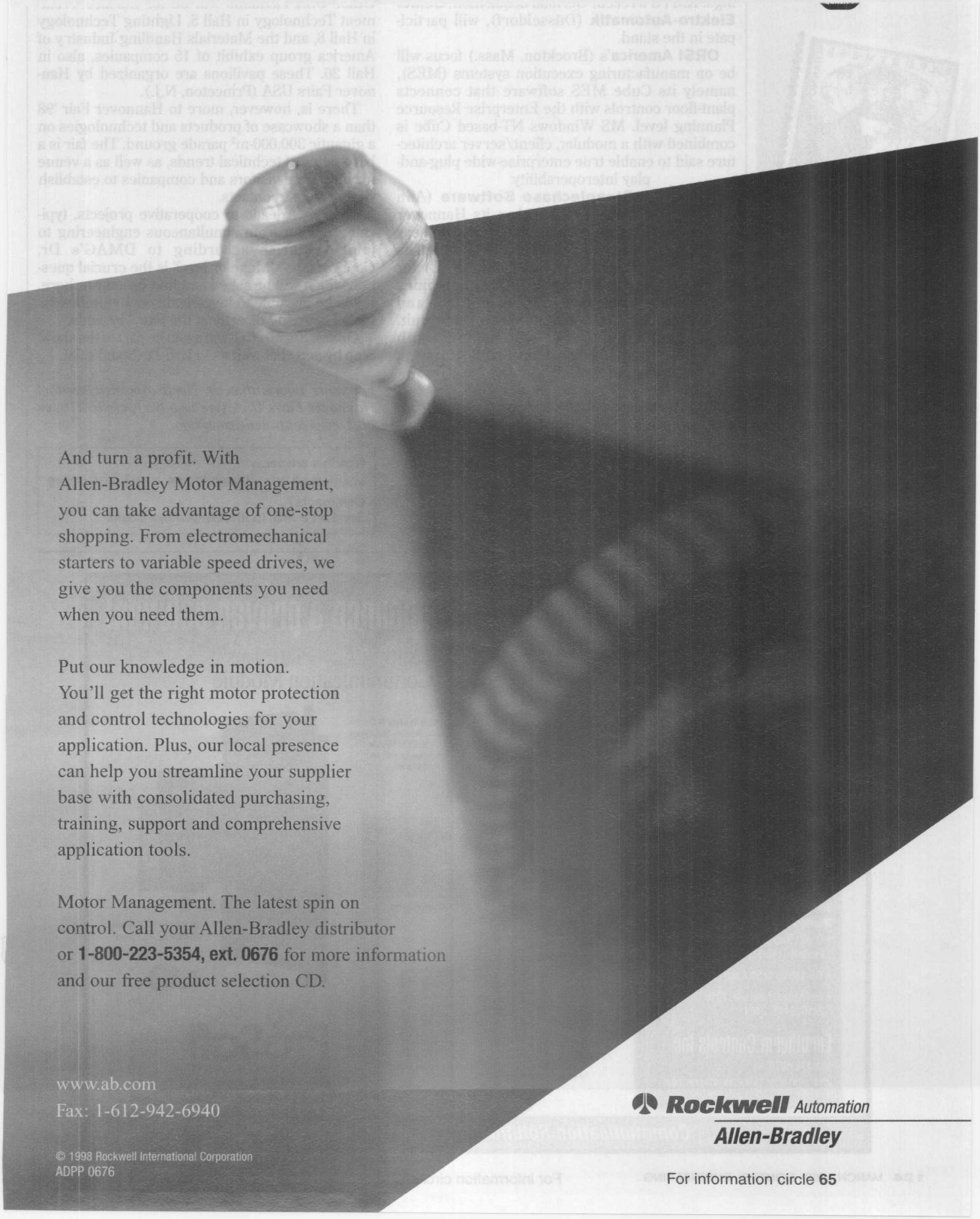
Contemporary Controls (Downers Grove, Ill.) will again join the **AUG** (ARCNet User Group) pavilion, displaying its robust ARCNet product line. The company will also be part of the **Open DeviceNet Vendors Association** (Coral Springs, Fla.) exhibit to present its new CAN-Bridge for extending CAN-based technology networks over distances of up to four miles.

Several U.S. motion control vendors will be represented by their European agent **SCT-Servo Control Technology GmbH** (Taunusstein, Germany). Among them are **Copley Controls Corp.** (Westwood, Mass.) highlighting its new Sinusoidal/Trapezoidal Series PWM servo amplifiers for several servo motor types. **Emerson EMC** (Chanhassen, Minn.) is set to show its new multi-axis controller, Axima 4000, and latest E Series drives. Also part of the SCT stand, **Technology 80** (Minneapolis, Minn.) will emphasize PC 104 bus architecture for motion control. Its 4-axis, DSP-based servo controller on PC 104 form factor will be among products on display.

Fibox Oy (Jorvas, Finland) and its U.S. division, **Fibox Inc.** (Elkridge, Md.), will introduce a line of harsh-environment plastic enclosures to house and protect electronic equipment. MNX corrosion-proof enclosures are rated IEC IP67 and NEMA 4, 4X, 6, 12, and 13. Size and material options allow over 100 off-the-shelf units. Fibox will sell the new MXN line in North America.

GE Industrial Control Systems (Salem, Va.) will feature Innovation Series medium-voltage drives/motors, also small drives and motors. The exhibit is in concert with offerings of **General Electric Co.**'s worldwide affiliate companies in a combined stand. Interconnectivity among the many products on display will be stressed.

Kollmorgen Motion Technologies Group (KMTG, Radford, Va.) will introduce the Platinum DDL direct-drive linear motor line to European markets, along with its 600-V-capable servo motor



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U.S. companies have a strong presence at Hannover Fair



Germany commemorated the fair's early days, then known as Export Fair, with sets of postage stamps in 1948 and 1949.

(Goldline XT600) and drive (Servostar 600) offerings. KMTG's recent German acquisition, **Seidel Elektro-Automatik** (Düsseldorf), will participate in the stand.

ORSI America's (Brockton, Mass.) focus will be on manufacturing execution systems (MES), namely its Cube MES software that connects plant-floor controls with the Enterprise Resource Planning level. MS Windows NT-based Cube is combined with a modular, client/server architecture said to enable true enterprise-wide plug-and-play interoperability.

Steeplechase Software (Ann Arbor, Mich.) makes its Hannover Fair debut. To be showcased are automation control capabilities of its Visual Logic Controller (VLC) for MS Windows NT. VLC combines integrated motion control and advanced diagnostics in one unit. Steeplechase will partner with Benelux distributor, **ATS** (Haarlem, The Netherlands), in Hall 16.

USA pavilions: 35% larger than '97

U.S. companies have a strong presence because they operate on several fronts. They're represented as "independent exhibitors" (this includes European subsidiaries and affiliates of U.S. firms), by expert European distributors as noted above, as well as part of the expanded USA Pavilions. In 1998 the main USA Pavilion of over 11,000 ft^2 will house some 70 companies in Hall 26. Other USA Pavilions will be for Surface Treatment Technology in Hall 5, Lighting Technology in Hall 8, and the Materials Handling Industry of America group exhibit of 15 companies, also in Hall 26. These pavilions are organized by Hannover Fairs USA (Princeton, N.J.).

There is, however, more to Hannover Fair '98 than a showcase of products and technologies on a gigantic 300,000-m^2 parade ground. The fair is a barometer of technical trends, as well as a venue for individual visitors and companies to establish vital business contacts.

This often leads to cooperative projects, typically ranging from simultaneous engineering to joint ventures, according to DMAG's Dr. Goehrmann. " 'Make or buy?' is the crucial question which will be asked and find its answer here. It will be possible to investigate opportunities for global sourcing directly at the Fair," he adds.

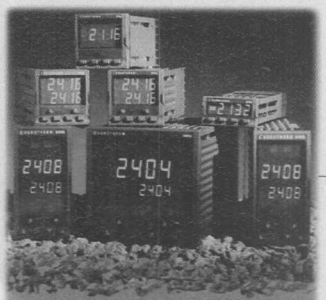
Control Engineering will again be part of the show. Stop by and chat with us in Hall 12 (Stand E58). □

For more information in North America, contact Hannover Fairs USA (see logo box), circle 210, or visit www.controleng.com/info.

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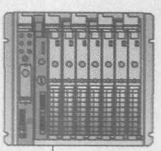
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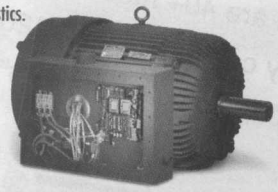
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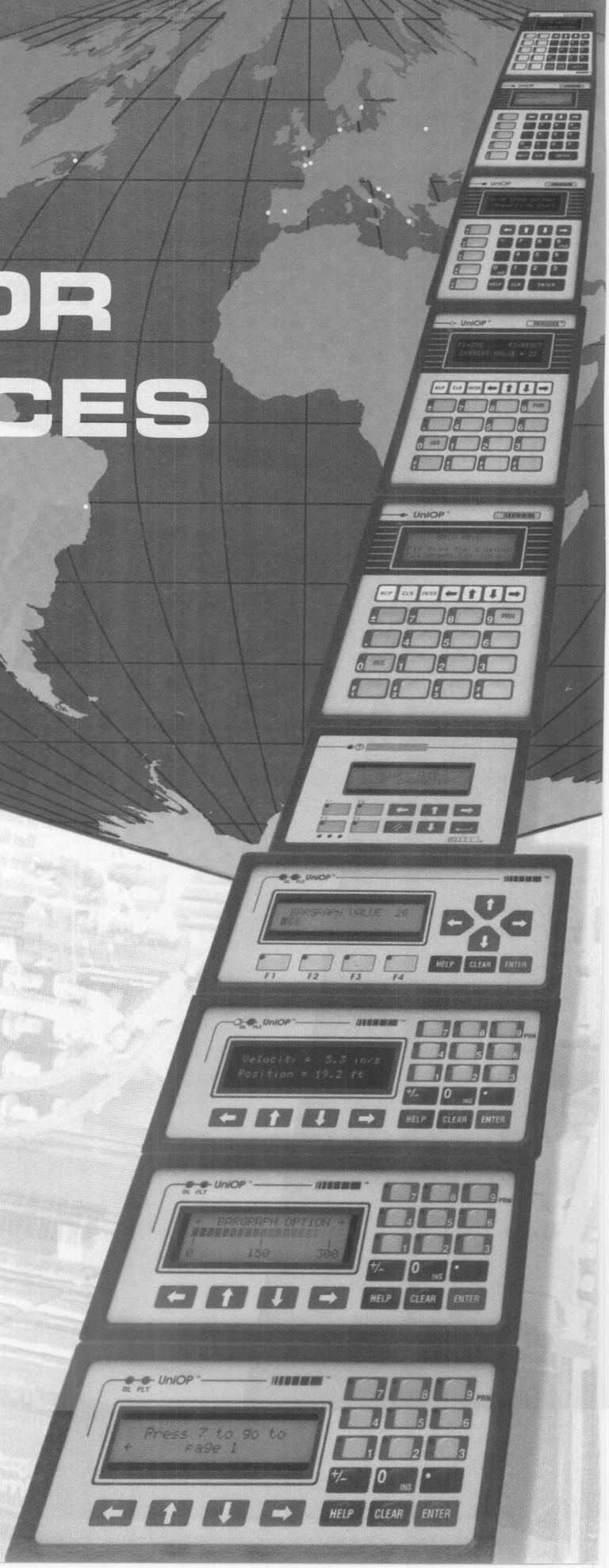
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PLC I/O Devices: More Options for Better Machine Control

New developments in I/O modules and devices give more options and offer ways to cut costs.

Gary A. Mintchell, *CONTROL ENGINEERING*

PLC I/O devices have gone a long way from being wiring devices on a backplane. Once thought to be dinosaurs replaced by smart sensors and device networks, I/O devices are showing new life by offering users new ways to improve control of machines in a cost-effective manner. Several trends in the market are occurring simultaneously, but all have one direction—increased opportunities for the user to select the control solution that best fits the needs of each unique situation.

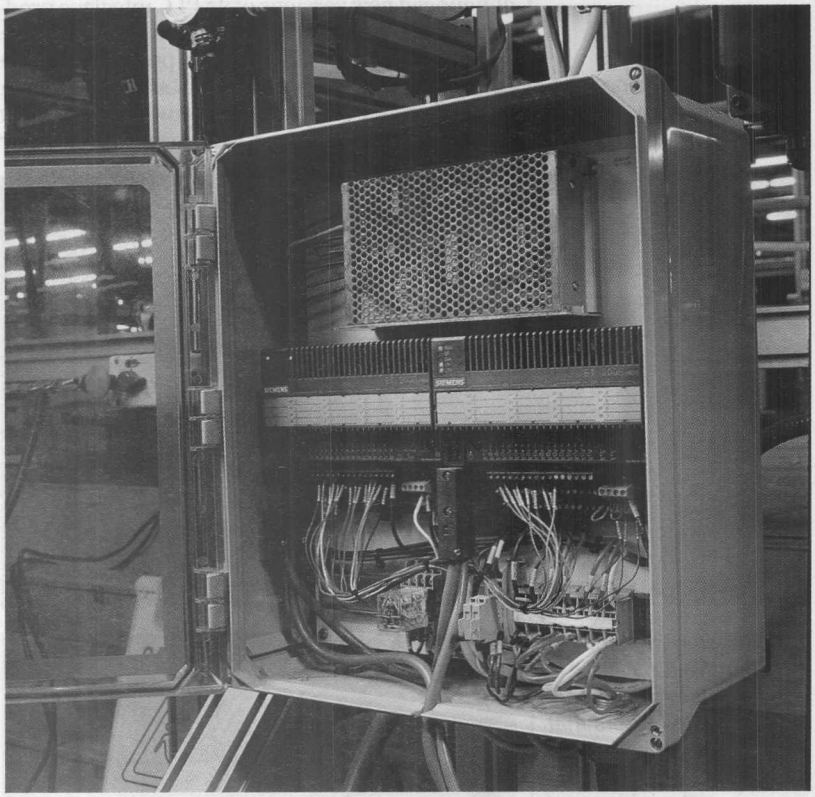
I/O is no longer the domain of proprietary architectures. Reed Ashmore, I/O product manager at GE Fanuc Automation (Charlottesville, Va.), points out that customers no longer limit themselves to a single vendor for the various components of a control system. Customers like the modularity available now so that they are not limited by the number of open slots in a PLC rack. In addition, Mr. Ashmore sees requests for specialized modules like thermocouple, strain gage, and motion control increasing.

"One of the key trends in I/O subsystems is a wider availability of unbundled products, like distributed 'rack,' 'block,' and 'direct' (sensor/actuator) I/O devices that are mated to alternative 'brains,' such as a personal computer," notes Trayton Jay of Mitsubishi Electric Automation Inc. (Vernon Hills, Ill.). " 'Open' standards promote inter-vendor product compatibility. This allows customers to keep the advantages of compact, rugged PLC I/O modules where appropriate and to access [what some perceive as] more open, flexible, or advanced programming and integration environments."

Higher density means wiring woes

Mr. Ashmore calls the "biggest contradiction in customer requests" the fact that customers want more I/O points in a smaller card with the ability to switch higher energy.

Joe Pickell, product manager for PCD Inc. (Peabody, Mass.) a manufacturer of termination systems, feels that increasing density has been overlooked in most analyses of I/O modules. No longer satisfied with 8-point or even 16-point I/O cards, users now want to save space with 32-point and 64-point cards.



Siemens Simatic ET-200B is used with micro PLCs as a compact solution on a CD/Video sorting system.

Since these small footprints and compact terminations are harder to wire using conventional methods, manufacturers are now using prefabricated cable assemblies rather than discrete point-to-point wiring. This has the further benefit of reducing the potential for cross wiring and other wiring problems.

Other problems that Mr. Pickell discusses include the susceptibility of high density cards to damage. Damage on one channel can potentially wipe out a large portion of a system as the high I/O count card is being replaced. This means an increased need to take protective measures in the termination area.

He adds that with systems becoming more complex and the need for automated testing growing, test ports must be provided in the connection scheme. PCs, now more prevalent in the industrial world, typically have some type of multipin connector for I/O devices creating a demand for interface modules.

"Control systems are becoming more critical to all plant operations," concludes Mr. Pickell.

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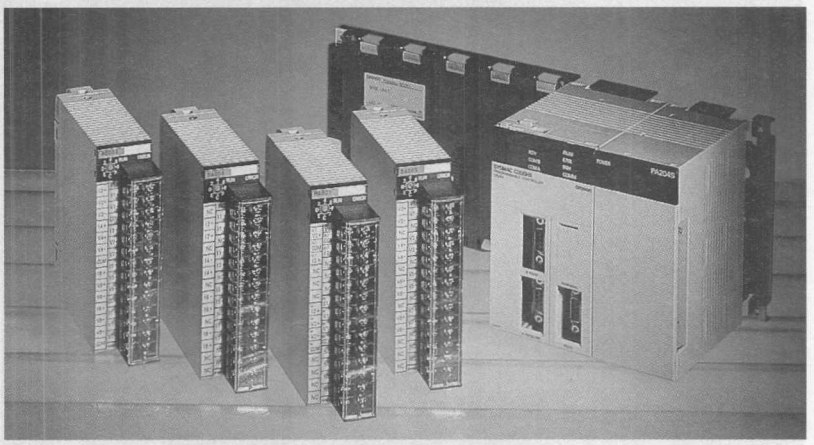


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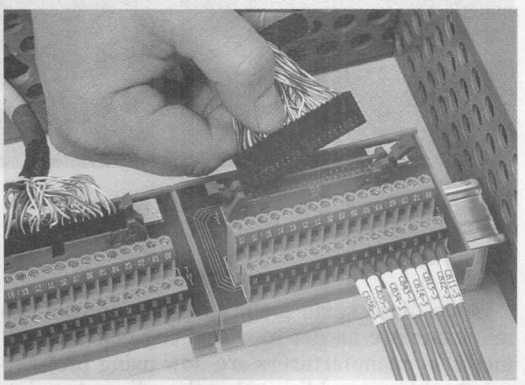
downtimes must be minimized. This is leading to increased need for termination systems that can be quickly unplugged in the event of a failure."

One company that has capitalized on two trends in I/O devices—increased density of modules and willingness of engineers to use third-party solutions—is Weidmuller Inc. (Richmond, Va.). It has announced new versions of its PLC interface products for Modicon's Quantum PLCs and GE Fanuc Series 90-70 PLCs. The line of products for the Allen-Bradley PLC-5, and SLC-500 has also been expanded. These join versions that support Siemens, Mitsubishi and Omron as well as other Allen-Bradley, GE Fanuc, and Modicon products.

Omron's new high-density analog modules feature eight channels. ▼



The plug-in nature of the Weidmüller PLC interface not only eliminates errors that can occur with hand wiring, it also speeds up the wiring and check-out process. Here, the PLC cable is connected to the field interface module. ▶



The Weidmuller PLC Interface system consists of either two or three components which replace the I/O card terminal strip and the rail of terminal blocks. This reduces the large number of wires that has to be individually connected by an electrician with the resulting chance for errors.

Weidmuller also contributes to the high-density trend. It has just released a family of compact, high-density interface relay modules. The Plug-Pak eight channel relay module is only 22.5 mm wide featuring 24 Vdc operation, LED coil indication and pluggable inputs and outputs. The UPAC relay module has 4 contacts in a 17.7 mm wide housing. The DK5R-SPNO (single-pole-normally-open) and DK5R-SPDT (single-pole-double-throw) are only 6 mm offering 4000 V surge isolation, LED status and diode protection.

Spectrum Controls (Bellevue, Wa.) is releasing an eight-channel thermocouple/millivolt analog input module specifically for the Allen-Bradley 1746 I/O structure. The 1746sc-NT8 is individually configurable for each channel for either thermocouple type or millivolt input range. Designers can save rack space and extra modules reducing costs.

Another new high-density offering is from Omron Electronics (Schaumburg, Ill.). These new eight-point analog modules offer conversion rates of 1 microsecond per point, incorporate independent offset and gain adjustments for each input or output, and continuous monitoring for real-time error detection.

Opto 22 (Temecula, Calif.) has also capitalized on two trends developing in I/O configuration. The company believes that the biggest impact on the current market is in device-level networks combined with the opening up of I/O systems to many different vendors. The Opto 22 Snap I/O is a small rack which can be panel mounted or DIN rail mounted. It is then populated with a variety of small, high-density modules and a "brain," which communicates via various network protocols to a controller. Supported networks to date are Optomux, Pamux, Mistic, DeviceNet and SDS. Soon to come are Modbus and Profibus, the company says.

More networking choices shrink cost

The talk about one industry standard device-level network may still be continuing, but manufacturers are not waiting for the dust to settle before implementing solutions. There are several networks on the market today. Each offers users the opportunity to hang I/O devices out on the machine away from the main controller. This means that electricians only run one cable back to the panel. Savings result from less wiring and from fewer processors—sometimes with microcontrollers acting as both local logic and I/O module.

David Pokraka, I/O systems specialist of Siemens Energy & Automation Inc. (Alpharetta, Ga.) sees major benefits coming from this emphasis on networking. By standardizing on the Profibus device network, Siemens has focused on developing special I/O modules such as a waterproof block and modular high-density blocks. The user will benefit from the flexibility of tailoring a solution to the need at the machine level. Just because one part of the plant uses high-density modules, the application on the other side of the plant needing only a few points is not forced to use a larger device than it needs.

Siemens has introduced a stretch version of its "Logo!" universal logic module. The Logo!-L, while only two inches longer, has double the I/O to 12 inputs and 8 outputs. It fills the performance range just below the microPLC yet has an optional AS-interface bus module to integrate into a larger control system.

"Bus systems are differentiated by their performance, throughput, diagnostics capabilities, and the number of I/O which can be connected," says Bjeorn Falke, application engineer with Phoenix Contact Inc. (Harrisburg, Pa.). "Interbus is designed for the real-time transport of digital and

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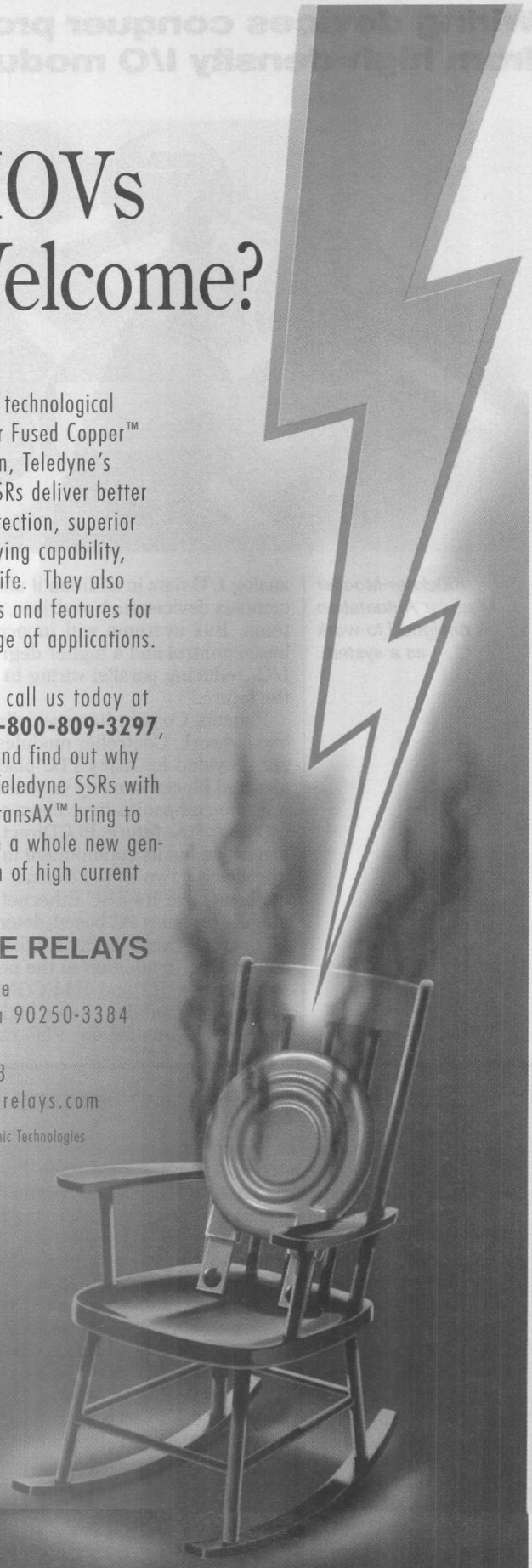
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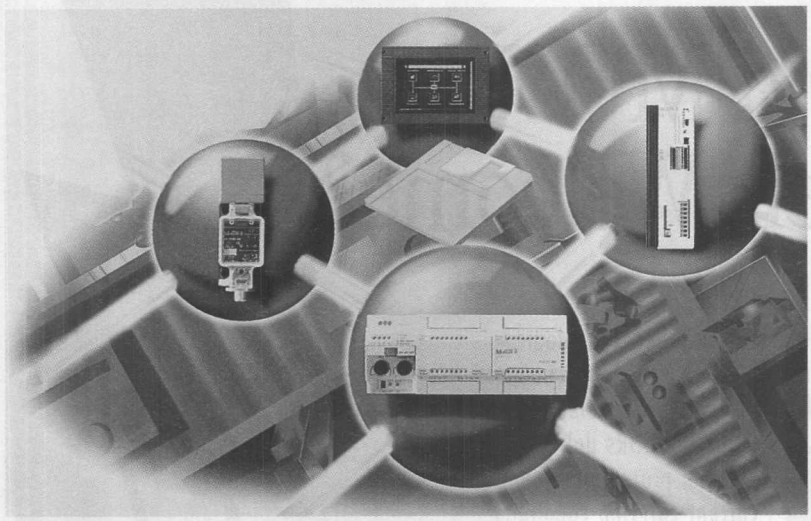
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Wiring devices conquer problems from high-density I/O modules



Klöckner-Moeller Modular Automation is designed to work as a system.

analog I/O data in addition it also supports more complex devices such as drives, robots, or ID systems. Bus systems will incorporate more PC based control and a higher degree of distributed I/O, reducing parallel wiring to the minimum in the future."

Phoenix Contact has specialized on the Interbus network. Controller modules for the network are provided for many PLC platforms. I/O modules and blocks in many varieties are available.

Some companies have chosen Ethernet as the I/O bus of the future. PLCDirect (Cumming, Ga.) has expanded its commitment in this direction by introducing two new Ethernet communications modules. The H4-EBC Ethernet Base Controller module provides PC-based, deterministic, remote I/O control functionality for the DL405 family of controllers. In addition to the new H4-EBC module, the new H2 and H4-ECOM Ethernet Communication modules enable high-speed Ethernet communications among PLC racks and provide PLC to PC communications using PLCDirect's DirectSoft PC-DDE server software.

Rockwell Automation/Allen-Bradley (Milwaukee, Wis.) has introduced the ArmorBlock Low Profile (LP), a smaller member of its ArmorBlock I/O family. ArmorBlock I/O combines an adapter, power supply, rack and I/O into one industrially sealed package. This family of modules distributes I/O points closer to the application which helps reduce the cost of wiring and increases flexibility for the designer. The ArmorBlock family suppports the DeviceNet network.

Action Instruments (San Diego, Calif.) believes in giving I/O function that is not network specific. Action's "buss-ticket" allows the selection of the device network or fieldbus of the user's choice. The "I/O with I/Q" includes a rail which has connections for power and network for each module. Power, network, I/O and buss-ticket modules all plug in to the rail. Action Instruments provides a variety of special modules—signal conditioners, programmable two-wire transmitters, limit alarms and loop isolators.

Entrelec's (Irving, Tex.) new "RIO" I/O module features a building block concept for remote bus interface and distributed intelligence. The main terminal block with plug in electronic modules is compatible with Profibus 1.5 MB, Profibus 12 MB, Interbus, Interbus "E" and WorldFip. The main bus node terminal block module includes eight digital inputs and eight digital outputs. Additional I/Os can be added with an expansion terminal block. The "RIO" line is compatible with Entrelec's "Systron" modular I/O system. Entrelec's product specialist, Bryan Moore, states, "The new RIO line of remote I/O modules is a flexible, cost-effective design because it offers the user options for selecting bus systems, expansion capability, two or three wire I/Os and mounting configuration."

Wieland's "ricos" products combine a fieldbus interface module with both digital and analog I/O

Do Intelligent Sensors Signal End of I/O Modules?

A computer chip can be implanted into almost anything today. A few years ago, the industry started putting more and more intelligence in its sensors. Remember the introduction of fuzzy logic in various kinds of sensors? Add to this the acceptance of device-level networks and many argued there may be little or no need for a controller.

At the introduction of these new intelligent sensors, manufacturers said that many, if not most, decisions could now be made directly from the sensor to the output device, completely bypassing the controller. The only purpose of the controller for this type of transaction was to monitor and override. The user saw two major benefits. First, the speed of the system could be greatly enhanced with no need to wait for the scan time of the processor. The size of the controller and its complementary I/O racks and modules could be reduced, saving money.

But these features also increase cost and complexity of the sensors. It often makes more sense to use the same sensors and other field devices that are already in stock and add value to the I/O modules and devices (the component between the sensor, contactor, etc. and the controller).

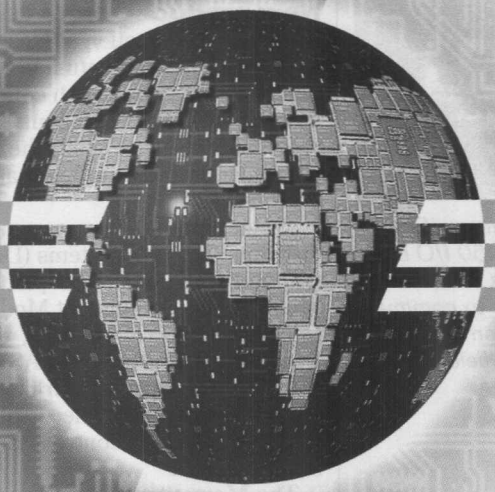
Rockwell Automation's (Milwaukee, Wis.) Bob Lennon, vice president of the I/O business, sees two trends in the market, both placing more value on the I/O solution. "The first shows I/O products becoming more highly distributed and operating more independently from the master controller," says Mr. Lennon. "The other trend shows I/O products becoming more tightly integrated with the controller, which supports centralized I/O solutions." In both environments Rockwell Automation sees more and more value migrating into the I/O solution.

Customers are driving manufacturers to find new and innovative ways to find new solutions to specific manufacturing problems. This means open systems, multiple-vendor solutions, and application specific devices.

Are intelligent sensors going to replace I/O modules in the near future? The answer is resoundingly, " No."

What do you think? Send comments to gmintchell@cahners.com.

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More and more value is migrating to the I/O solution



Cutler-Hammer/Eaton's new DN50 I/O block allows a DeviceNet processor to communicate with non-DeviceNet field devices.

units. Ricos supports Profibus, Interbus, Modbus Plus, DeviceNet, and SDS.

New products, more choices

Schneider Automation's (North Andover, Mass.) Modicon TSX Momentum product designed as a new modular system with controller, I/O system, and networking components. Its open architecture concept gives users the flexibility to solve particular problems rather than forcing packaged solutions to fit.

Momentum I/O components work well with distributed control systems (DCS), PC-based control and traditional PLC platforms. Supporting Modbus Plus, Redundant Modbus Plus, FIP I/O, Interbus, and Profibus now, with Ethernet I/O, DeviceNet, ControlNet, ASi, and Seriplex to come, Momentum will work in almost any control environment. An engineer will not be forced to throw out existing controls that still work to add new functions.

The Momentum Processor Adapter allows the system to act as distributed intelligence in a larger system controlled by a Modicon Compact or Quantum PLC system.

For those who are installing a DeviceNet system in a machine with existing input and output devices, Cutler-Hammer/Eaton (Milwaukee, Wis.) has just released the DN50 I/O block. According to Greg Bell, PLC/Operator Interface product manager, "The features designed into this I/O block offer users the flexibility to adapt to applications easily, as well as make changes as their requirements change. With the variety of I/O configurations offered, virtually any device can be connected to a DeviceNet system."

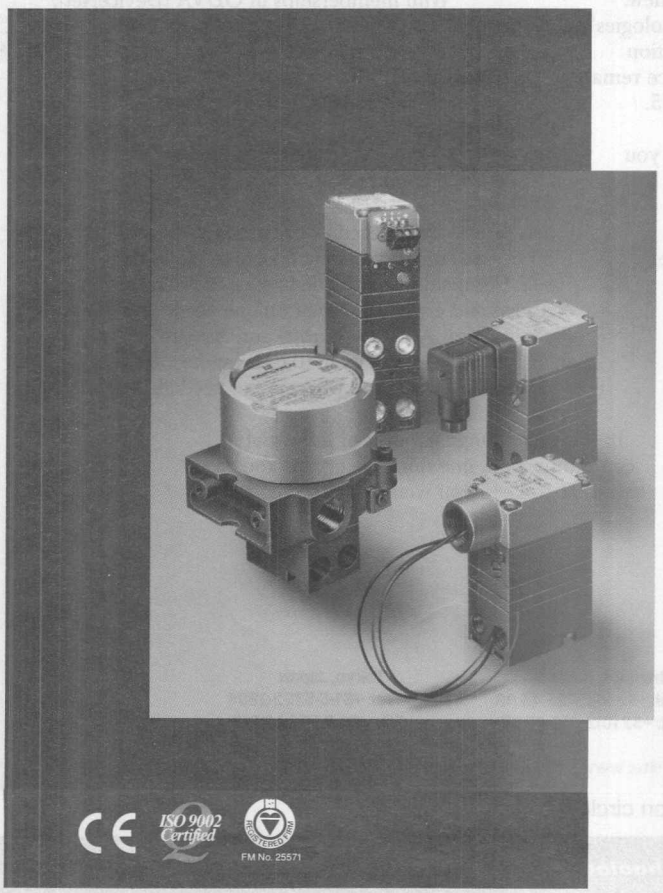
A device without a CAN (Controller Area Network) communications chip is wired to the DN50 and can communicate over the network. Programming and configuring is done with Cutler-Hammer's NetSolver and NetView software packages. The user can troubleshoot, set attributes and gather diagnostic information from these devices.

Specialty modules increase options

GE Fanuc has released a high-density, standalone thermocouple module for its Series 90-30 PLCs. The TCM provides eight thermocouple inputs (J, K or L type), one RTD input, and eight PID-controlled solid state 24 Vdc outputs for controlling heaters. Each channel can operate in either closed- or open- loop mode. It features autotuning and diagnostics.

An interesting approach to distributing I/O devices is taken by Festo Corp. (Hauppauge, N.Y.). It has embedded Allen-Bradley SLC 5/02 technology into a pneumatic valve manifold. Communicating over either DeviceNet or Allen-Bradley's DH-485 network, the smart manifold can operate as part of a larger control system or operate as a stand-alone controller.

Klöckner-Moeller has added two specialty modules to its PS4 family. The EM4-101-TX1 is a network temperature module that monitors locally



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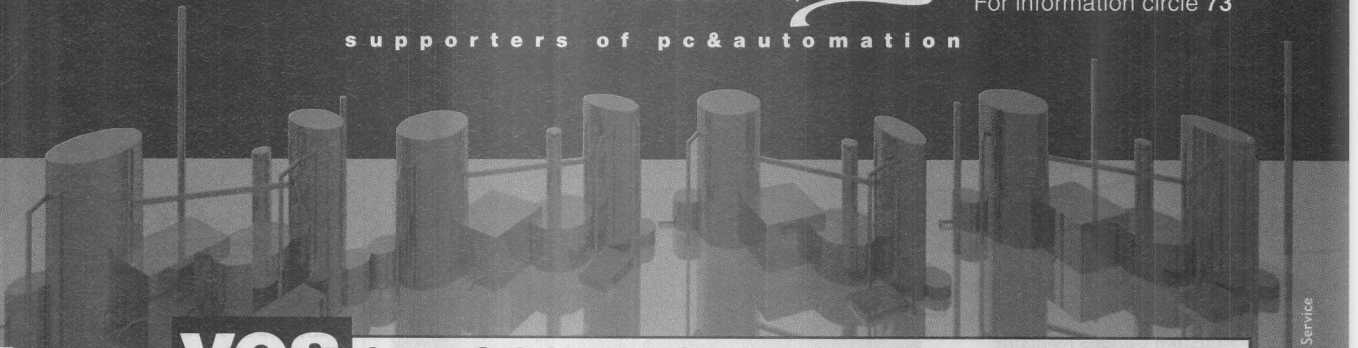
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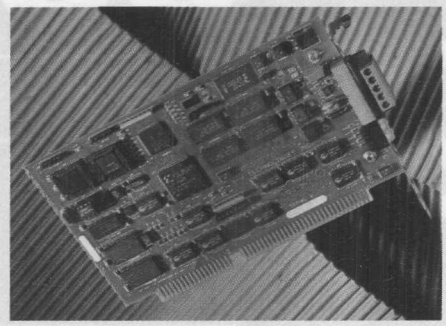
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troller. It has six inputs for measuring temperature plus two standard ±10 Vdc analog inputs for monitoring other process variables. The LE4-622-CX1 positioning module reads encoder input and sends commands from the PS4 controller to the drive.

Is software important?

Intellution Inc. (Norwood, Mass.) and Grayhill Inc. (LaGrange, Ill.) have announced an agreement to port Intellu- ware to Grayhill's OpenLine controller (see related News article). Brian May, Grayhill's president of the Electronic Systems Division, believes that software is a crucial element for I/O device manufacturers. They need software support so that the devices can be easily used by various hardware platforms and human-machine interfaces. This software integration "will result in the simplest system to configure, program and troubleshoot

Steve Blakely, SST (Waterloo, Ontario, Canada) product manager, notes, "One trend we've noticed over the last few years with our network interface cards is the increased value customers place on the software available from the card vendor. We have taken a unique position in the marketplace by including all this soft-



SST's just released DeviceNet PC interface card, the DeviceNet Pro 5136-DNP is available in ISA, VME, and Multibus formats.

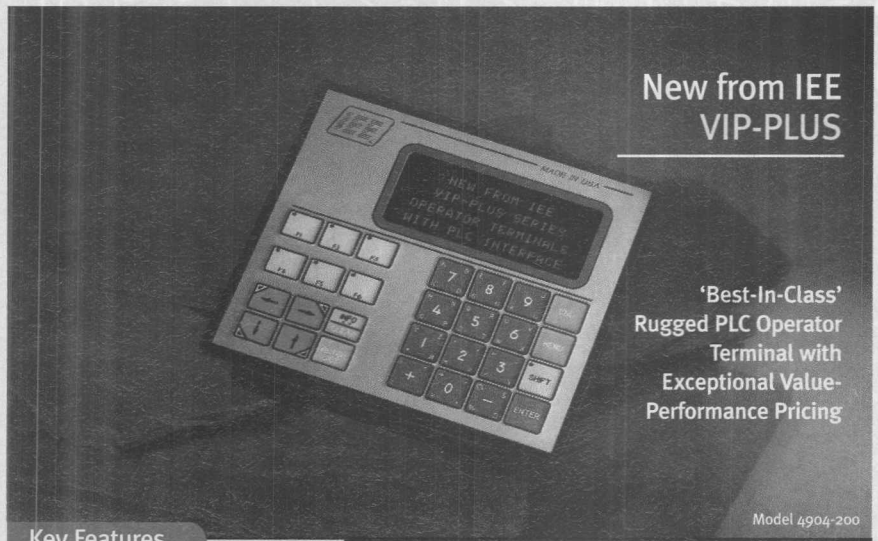
ware free-of-charge with our DeviceNet, Profibus, and ControlNet interface cards." SST (formerly SS Technologies) has just announced the DeviceNet Pro interface card. With enhanced features over the original DN card, The 5136-DNP is available for ISA, VME, and Multibus.

Given all these new developments in I/O modules and devices, engineers have a better opportunity to find the appropriate technical and economic solution for increasingly demanding problems. □

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Basics of Proportional-Integral-Derivative Control

PID controllers are by far the most popular feedback controllers for continuous processes. Here's a look at how they work.

Vance J. VanDoren, *CONTROL ENGINEERING*

A feedback controller is designed to generate an *output* that causes some corrective effort to be applied to a *process* so as to drive a measurable *process variable* towards a desired value known as the *setpoint*. The controller uses an *actuator* to affect the process and a *sensor* to measure the results. Figure 1 shows a typical feedback control system with blocks representing the dynamic elements of the system and arrows representing the flow of information, generally in the form of electrical signals.

Virtually all feedback controllers determine their output by observing the *error* between the setpoint and a measurement of the process variable. Errors occur when an operator changes the setpoint intentionally or when a process *load* changes the process variable accidentally.

In warm weather, a home thermostat is a familiar controller that attempts to correct temperature of the air inside a house. It measures the room temperature with a thermocouple and activates the air conditioner whenever an occupant lowers the desired room temperature or a random heat source raises the actual room temperature. In this example, the house is the process, the actual room temperature inside the house is the process variable, the desired room temperature is the setpoint, the thermocouple is the sensor, the activation signal to the air conditioner is the controller output, the air conditioner itself is the actuator, and the random heat sources (such as sunshine and warm bodies) constitute the loads on the process.

PID control

A proportional-integral-derivative or PID controller performs much the same function as a thermostat but with a more elaborate algorithm for determining its output. It looks at the current value of the error, the integral of the error over a recent time interval, and the current derivative of the error signal to determine not only how much of a correction to apply, but for how long. Those three quantities are each multiplied by a *tuning constant* and added together to produce the current controller output CO(t) as in equation [1]. In this equation, P is the *proportional* tuning constant, I is the *integral* tuning constant, D is the *derivative* tuning constant, and the error e(t) is the difference between the setpoint P(t) and the process variable PV(t) at time t. If the current error is large or the error has been sustained for

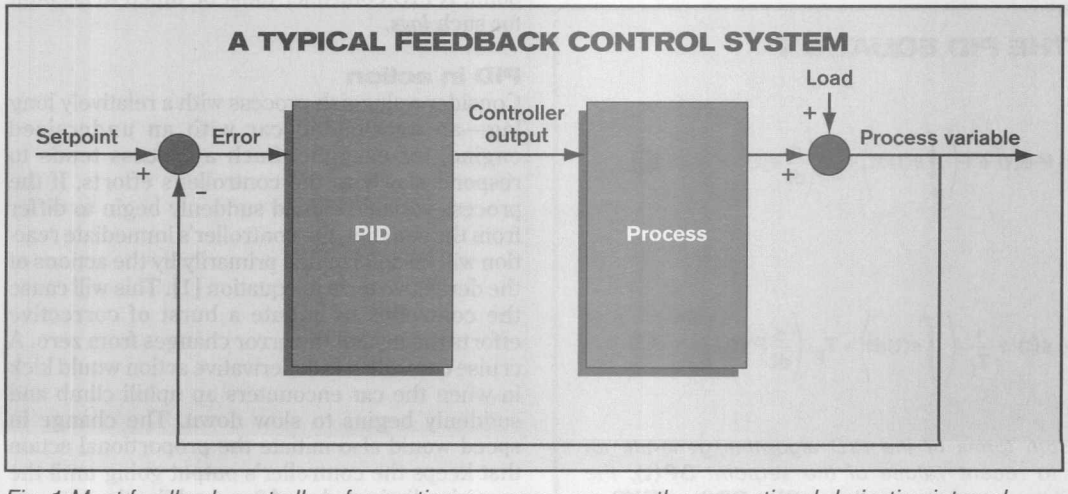


Fig. 1:Most feedback controllers for continuous processes use the proportional-derivative-integral (PID) algorithm to manipulate the process variable by applying a corrective effort to the process.

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KEY WORDS



- Process control & instrumentation
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P is the proportional tuning constant

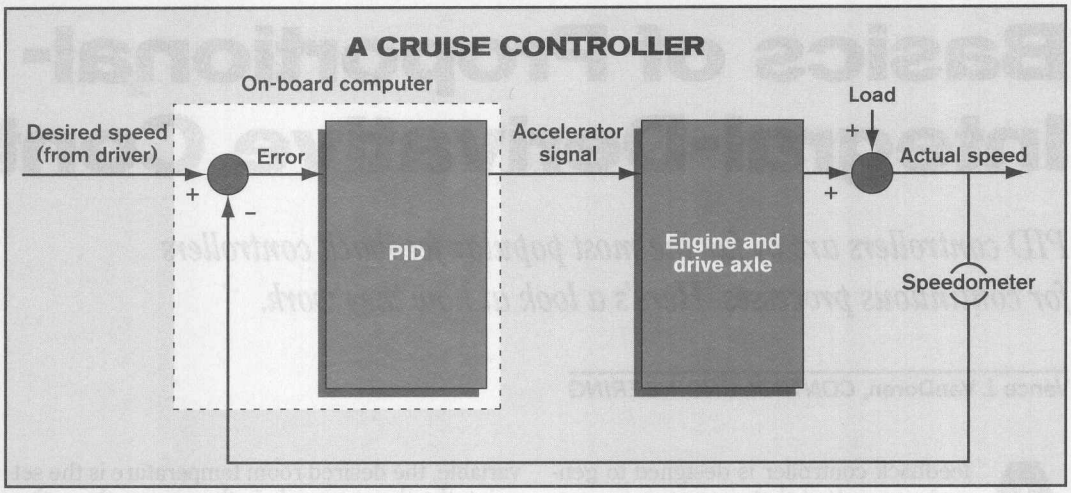


Fig. 2:A cruise controller attempts to minimize errors between the desired speed set by the driver and the car's actual speed measured by the speedometer. The controller detects a speed error when the desired speed is increased or when an added load (such as an uphill climb) slows the car.

some time or the error is changing rapidly, the controller will attempt to make a large correction by generating a large output. Conversely, if the process variable has matched the setpoint for some time, the controller will leave well enough alone.

Tuning the controller

Conceptually, that's all there is to a PID controller. The tricky part is *tuning* it; i.e., setting the P, I, and D tuning constants appropriately. The idea is to weight the sum of the proportional, integral, and derivative terms so as to produce a controller output that steadily drives the process variable in the direction required to eliminate the error.

The brute force solution to this problem would be to generate the largest possible output by using the largest possible tuning constants. A controller thus tuned would amplify every error and initiate extremely aggressive efforts to eliminate even the slightest discrepancy between the setpoint and the process variable. However, an overly aggressive controller can actually make matters worse by driving the process variable past the setpoint as it attempts to correct a recent error. In the worst case, the process variable will end up even further away from the setpoint than before.

On the other hand, a PID controller that is tuned to be too conservative may be unable to eliminate one error before the next one appears. A well-tuned controller performs at a level somewhere between those two extremes. It works aggressively to eliminate an error quickly, but without over doing it.

How to best tune a PID controller depends upon how the process responds to the controller's corrective efforts. Processes that react instantly and predictably don't really require feedback at all. A car's headlights, for example, come on as soon as the driver hits the switch. No subsequent corrections are required to achieve the desired illumination.

On the other hand, the car's cruise controller cannot accelerate the car to the desired cruising speed so quickly. Because of friction and the car's inertia, there is always a delay between the time that the cruise controller activates the accelerator and the time that the car's speed reaches the setpoint. A PID controller must be tuned to account for such *lags*.

PID in action

Consider a sluggish process with a relatively long lag—an overloaded car with an undersized engine, for example. Such a process tends to respond slowly to the controller's efforts. If the process variable should suddenly begin to differ from the setpoint, the controller's immediate reaction will be determined primarily by the actions of the derivative term in equation [1]. This will cause the controller to initiate a burst of corrective efforts the instant the error changes from zero. A cruise controller with derivative action would kick in when the car encounters an uphill climb and suddenly begins to slow down. The change in speed would also initiate the proportional action that keeps the controller's output going until the error is eliminated. After a while, the integral term will also begin to contribute to the con-

THE PID EQUATION

In theory...

$$CO(t) = P \cdot e(t) + I \cdot \left(\int e(t)dt \right) + D \cdot \left(\frac{d}{dt} e(t) \right) \quad (1)$$

In practice...

$$CO(t) = P \cdot \left[e(t) + \frac{1}{T_I} \cdot \left(\int e(t)dt \right) - T_D \cdot \left(\frac{d}{dt} PV(t) \right) \right] \quad (6)$$

Equations [1] and [6]–Both forms of the PID algorithm generate an output **CO(t)** *according to recent values of the setpoint* **SP(t)**, *the process variable* **PV(t)**, *and the error between them* **e(t) = SP(t) – PV(t)**

A TYPICAL PROCESS MODEL

$$PV(t) = K \cdot CO(t - d) - T \cdot \left(\frac{d}{dt} PV(t) \right) + LV(t) \quad (2)$$

Equation [2]–The process variable **PV(t)** *is a function of its own derivative plus an earlier output from the controller* **CO(t–d)** *and a random load variable* **LV(t)**. *A PID controller for this process can be tuned according to the values of the parameters* **K**, **T**, *and* **d**.

troller's output as the error accumulates over time. In fact, the integral action will eventually come to dominate the output signal since the error decreases so slowly in a sluggish process. Even after the error has been eliminated, the controller will continue to generate an output based on the history of errors that have been accumulating in the controller's integrator. The process variable may then *overshoot* the setpoint, causing an error in the opposite direction.

If the integral tuning constant is not too large, this subsequent error will be smaller than the original, and the integral action will begin to diminish as negative errors are added to the history of positive ones. This whole operation may then repeat several times until both the error and the accumulated error are eliminated. Meanwhile, the derivative term will continue to add its share to the controller output based on the derivative of the oscillating error signal. The proportional action, too, will come and go as the error waxes and wanes.

Now suppose the process has very little lag so that it responds quickly to the controller's efforts. The integral term in equation [1] will not play as dominant a role in the controller's output since the errors will be so short lived. On the other hand, the derivative action will tend to be larger since the error changes rapidly in the absence of long lags.

Clearly, the relative importance of each term in the controller's output depends on the behavior of the controlled process. Determining the best mix suitable for a particular application is the essence of controller tuning.

For the sluggish process, a large value for the derivative tuning constant D might be advisable to accelerate the controller's reaction to an error that appears suddenly. For the fast-acting process, however, an equally large value for D might cause the controller's output to fluctuate wildly as every change in the error (including extraneous changes caused by measurement noise) is amplified by the controller's derivative action.

Three tuning techniques

There are basically three schools of thought on how to select P, I, and D values to achieve an acceptable level of controller performance. The first method is simple trial-and-error—tweak the tuning constants and watch the controller handle the next error. If it can eliminate the error in a timely fashion, quit. If it proves to be too conservative or too aggressive, increase or decrease one or more of the tuning constants.

Experienced control engineers seem to know just how much proportional, integral, and derivative action to add or subtract to correct the performance of a poorly tuned controller. Unfortunately, intuitive tuning procedures can be difficult to develop since a change in one tuning constant tends to affect the performance of all three terms in the controller's output. For example, turning down the integral action reduces overshoot. This in turn slows the rate of change of the error and thus reduces the derivative action as well.

The analytical approach to the tuning problem is more rigorous. It involves a mathematical *model* of the process that relates the current value of the process variable to its current rate of change plus a history of the controller's output. Random influences on the process variable from sources other than the controller can all be lumped into a load variable LV(t). See equation [2]. This particular model describes a process with a *gain* of K, a *time constant* of T, and a *deadtime* of d. The process gain represents the magnitude of the controller's effect on the process variable. A large value of K corresponds to a process that amplifies small control efforts into large changes in the

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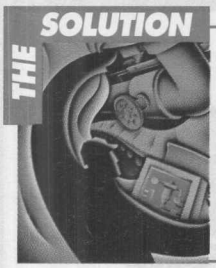
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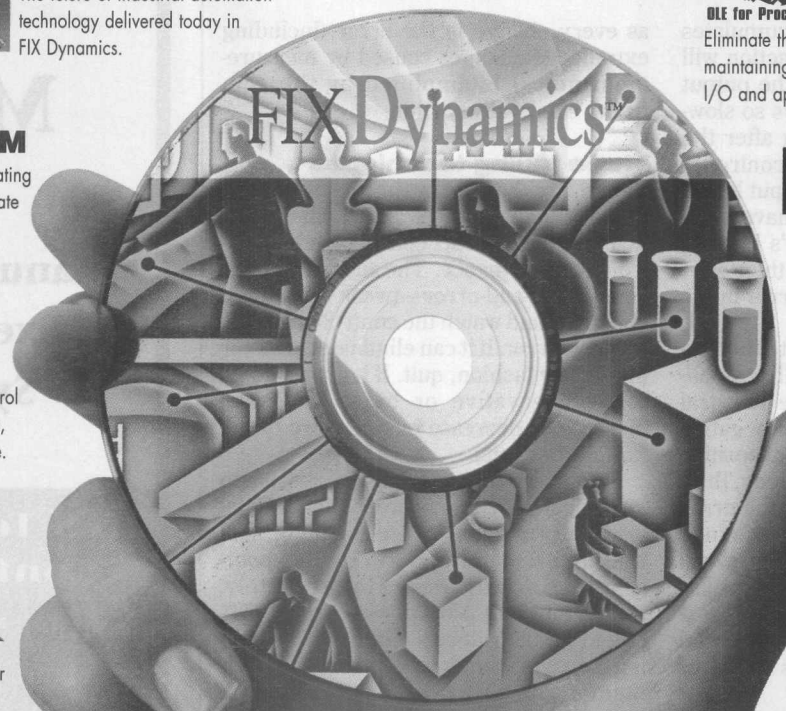
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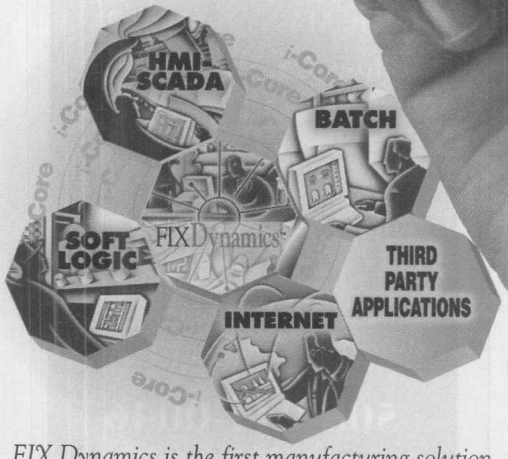
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D is the derivative tuning constant

A PROCESS MODEL FOR A CAR WITH CRUISE CONTROL

$$F_{engine}(t) - F_{friction}(t) - F_{load}(t) = m \cdot a(t) \quad (3)$$

$$K_{engine} \cdot CO(t) - K_{friction} \cdot v(t) - F_{load}(t) = m \cdot \left(\frac{d}{dt} v(t) \right) \quad (4)$$

$$v(t) = K \cdot CO(t) - T \cdot \frac{d}{dt} v(t) + LV(t) \quad (5)$$

Equations [3], [4], and [5]—The car's velocity **v(t)** *is a function of the cruise controller's output* **CO(t)**, *the car's current acceleration* **a(t)**, *and a load variable* **LV(t)**. *The load variable represents forces on the car from sources other than the engine and friction.*

process variable.

Time constant T in equation [2] represents the severity of the process lag. A large value of T corresponds to a long lag in a sluggish process. The deadtime d represents another kind of delay present in many processes where the controller's sensor is located some distance from its actuator. The time required for the actuator's effects to reach the sensor is the deadtime. During that interval, the process variable does not respond at all to the actuator's activity. Only after the deadtime has elapsed does the lag time begin.

In the thermostat example, the ductwork between the air conditioner and the thermostat causes a deadtime since each slug of cool air takes time to travel the duct's length. The room temperature will not begin to drop at all until the first slug of cool air emerges from the duct.

Other characteristics of process behavior can be factored into a process model, but equation [2] is one of the simplest and most widely used. It applies to any process with a process variable that changes in proportion to its current value. For example, a car of mass m accelerates when its cruise controller calls for the engine to apply a force $F_{engine}(t)$ to the drive axle. However, that acceleration a(t) is opposed by frictional forces $F_{friction}(t)$ that are proportional to the car's current velocity v(t) by a factor of $K_{friction}$. If all other forces impeding the car's acceleration are lumped into $F_{load}(t)$ and the force applied by the engine $F_{engine}(t)$ is proportional to the controller's output by a factor of K_{engine}, then v(t) will obey equation [2] as shown in equations [3] through [5].

In equation [5], the process variable is v(t) and the load variable is $LV(t) = -F_{load}(t)/K_{friction}$. The process gain is $K = K_{engine}/K_{friction}$ and the process time constant is $T = m/K_{friction}$. In this example there is no deadtime since the speed of the car begins to change as soon as the cruise controller activates the accelerator. The car will not reach its *final* speed for some time, but it will *begin* to accelerate almost immediately.

If a model like [2] or [5] can be defined for a process, its behavior can be quantified by analyzing the model's parameters. A model's parameters in turn dictate the tuning constants required to modify behavior of a process with a feedback controller. There are literally hundreds of analytical techniques for translating model parameters into tuning constants. Each approach uses a different model, different controller objectives, and different mathematical tools.

The third approach to the tuning problem is something of a compromise between purely heuristic trial-and-error techniques and the more rigorous analytical techniques. It was originally proposed in 1942 by John G. Ziegler and Nathaniel B. Nichols of Taylor Instruments and remains popular today because of its simplicity and its applicability to any process governed by a model in the form of equation [2]. The Ziegler-Nichols tuning technique will be the subject of "Back to Basics" (*CE*, Aug. 1998).

Application issues

Experienced PID users will note that none of the discussion so far applies directly to the commercial PID controllers currently running more than 90% of their industrial processes. Several sub-

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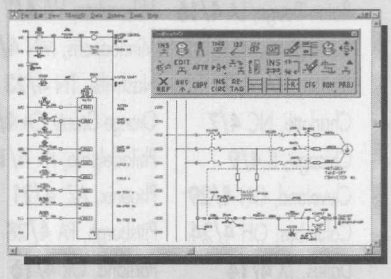
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Tuning a controller entails choosing appropriate values for P, I, and D.

tle flaws in the basic PID theory have been discovered during the last 50 years of real-life applications.

Consider, for example, the effects of *actuator saturation*. This occurs when the output signal generated by the controller exceeds the capacity of the actuator. In the cruise control example above, the PID formula may at some point call for a million 16 lbf-ft torque to be applied to the drive axle. Mathematically, at least, that much force may be required to achieve a particularly rapid acceleration.

Of course real engines can only apply a small fraction of that force, so the actual effects of the controller's output will be limited to whatever the engine can do at full throttle. The immediate result is a rate of acceleration much lower than expected since the engine is "saturated" at its maximum capacity.

However, it is the long-term consequences of actuator saturation that have necessitated a fix for equation [1] known as *antiwindup protection*. The controller's integral term is said to "wind up" whenever the error signal is stuck in either positive or negative territory, as in this example. That causes the integral action to grow larger and larger as the error accumulates over time. The resulting control effort also keeps growing larger and larger until the error finally changes sign and the accumulated error begins to diminish.

Unfortunately, a saturated actuator may be unable to reverse the error. The engine may not be able to accelerate the car to the desired velocity, so the error between the desired velocity and the actual velocity may remain positive forever. Even if the actual velocity does finally exceed the setpoint, the accumulated error will be so large by then that the controller will continue to generate a very large corrective effort. By the time enough negative errors have been accumulated to bring the integral term back to zero, the controller may well have caused the car's velocity to overshoot the setpoint by a wide margin.

The fix to this problem is to prevent integrator wind-up in the first place. When an actuator saturates, the controller's integral action must be artificially limited until the error signal changes sign. The simplest approach is to hold the integral term at its last value when saturation is detected.

Alternative implementations

The PID formula itself has also been modified. Several variations on equation [1] have been developed for commercial PID controllers; the most common being equation [6]. This version involves differentiating the process variable PV(t) rather than the error e(t) = SP(t) – PV(t). The idea here is to prevent abrupt changes in the controller's output every time the setpoint changes. Note that the results are the same when the setpoint SP(t) is constant.

The tuning constants in equation [6] differ from those in equation [1] as well. The controller's proportional gain now applies to all three terms rather than just the error e(t). This allows the overall "strength" of the controller to be increased or decreased by manipulating just P (or its inverse).

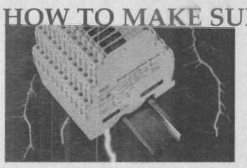
Several subtle flaws in the basic PID theory have been discovered during the last 50 years of real-life applications.

The other two tuning constants in equation [6] have been modified so that they may both be expressed in units of time. This also gives some physical significance to the *integral time* T_I. Note that if the error e(t) could somehow be held constant, the total integral action would increase to the level of the proportional action in exactly T_I seconds. Although the error should never remain constant while the controller is working, this formulation does give the user a feel for the relative strengths of the integral and proportional terms; i.e., a long integral time implies a relatively weak integral action, and vice versa. □

For more details on the practical issues of applying PID controllers to real-life control problems, circle 209 or refer to "Process Control Systems" by F. Greg Shinskey, available from the Foxboro Training Institute at 1-888-FOXBORO.
The author gratefully acknowledges Mr. Shinskey's assistance in the preparation of this article.

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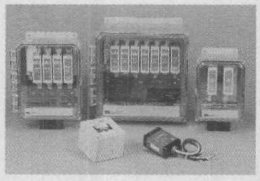
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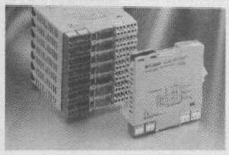
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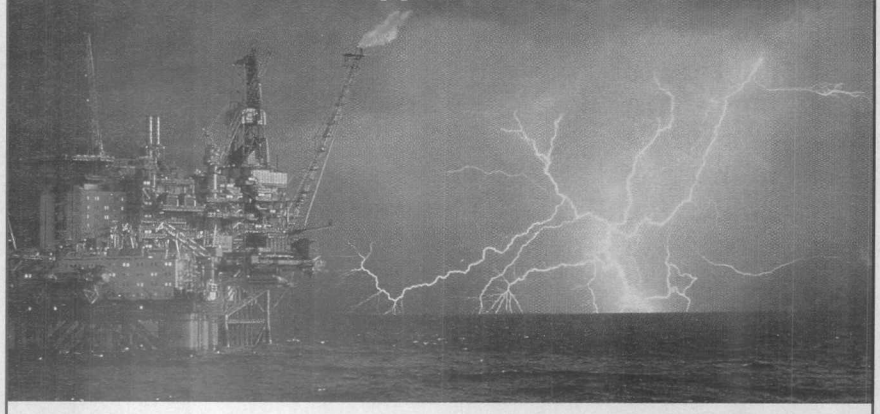
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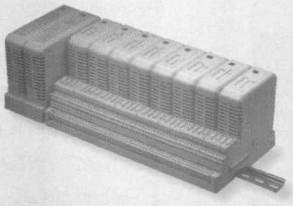
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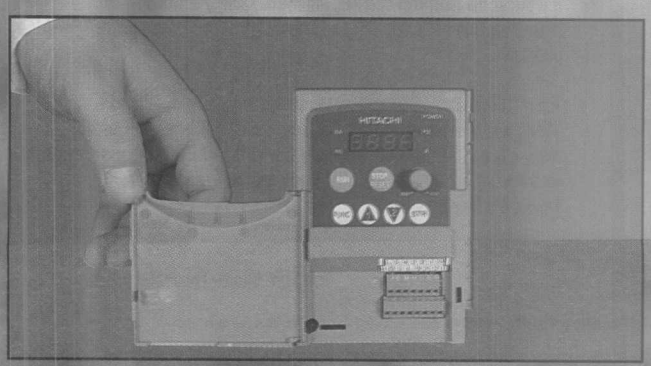
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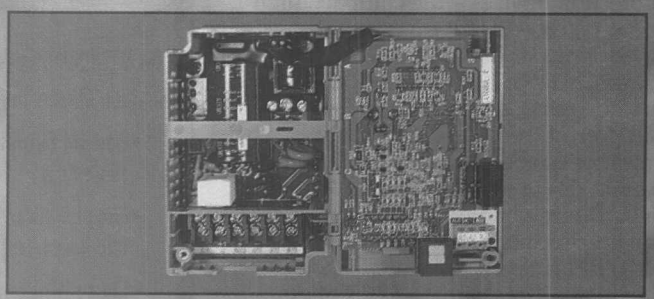
Although compact, the **L100** still has functions like PID control to automatically adjust the inverter output frequency to maintain a constant value. This feature is ideal for control of pressure or flow of either air or fliud. It also has 16 settings for multistage speed operation.

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How to Control Processes with Large Deadtimes

Large deadtimes present challenges for controllers. Here are some practical strategies.

John Gerry, ExperTune

Processes with large deadtimes present a special challenge for a controller—any controller. The controller must wait until the deadtime has passed before it gets any feedback from the process.

The best thing to do for controlling this type of process is to try to reduce the dead time. Simply moving a probe closer to the valve may do it. But sometimes there is nothing that can be done to the process. What then?

Picking and tuning

The control algorithm for a deadtime process is actually very simple. A PI controller does a fine job.

Other options for controllers include model-predictive; model-based; pole-cancellation; internal model control; dynamic-matrix controller; Dahlin; or a direct synthesis type. They all use a model inside the controller and could be called model-based controllers. These controllers can seek out slightly better response than PI—but sacrifice robustness.

The robustness penalty using model-based control (made to be even the same speed as a PI) is severe—process deadtime can go up or down and the loop will go unstable. Increasing deadtime for any process will eventually create instability. But decreasing deadtime to create instability is weirdly counter-intuitive. If the deadtime were to decrease with a PI controller, the loop would remain stable. So why not keep it simple and just use a PI controller?

The optimal tuning of a PI controller for a deadtime only process is simple:

- Controller gain = 0.3/(process gain);
- Integral time = 0.5 × (process dead time)

This tuning gives minimum error to a step-function upset in the process. The integral units are measured in minutes or seconds. For a slower response, simply lower the gain a little. (These equations apply for usual ideal and series PI algorithms. For a parallel algorithm, divide the integral time by controller gain.)

Additional lag

If the process has a small lag in addition to the deadtime, "cancel" the lag by setting the derivative time equal to it. This works if the lag is about five times less than the deadtime.

In the example shown in the first screen capture (Fig. 1), a process has a gain of one and deadtime of 120 min. It is controlled with a PI controller (red line) having an integral time of 60 min, and a gain of 0.3. It shows that 240 min or two deadtimes pass before the process reaches setpoint or recovers from an upset.

Filtering the process variable (second-order filter with a time constant of ⅒th the deadtime) will smooth out the sharp edges of the response (shown by the yellow line).

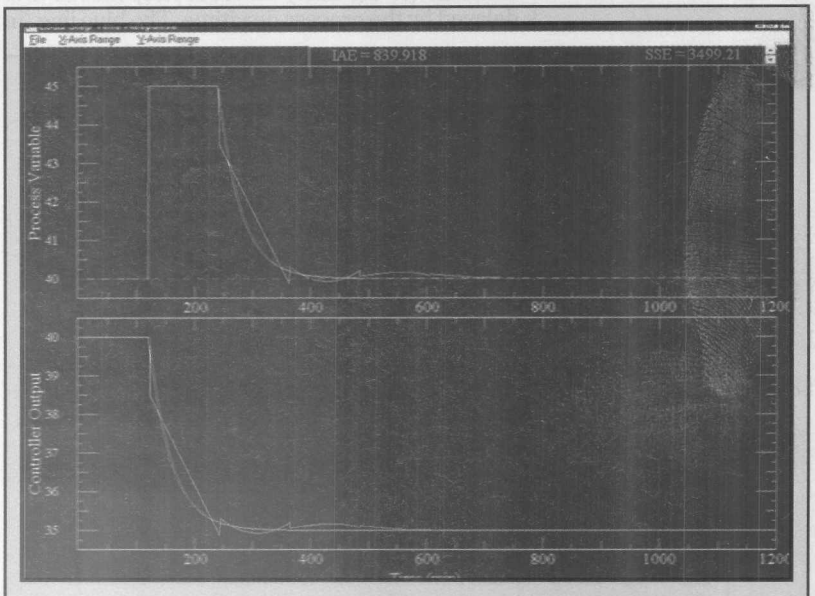


Fig. 1: Strategies vary in dealing with a 4-hr deadtime.

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KEY WORDS

- Process control & instrumentation
- Loop controllers
- Loop-tuning software
- PID (Proportional/ Integral/Derivative)

Adaptive deadtime

A powerful adaptive deadtime controller can be made if deadtime can be measured, or it's possible to infer deadtime from a variable like the speed of a machine or flow.

To make the controller adaptive, simply adjust the integral action in the controller using the above formula. Measuring or inferring the deadtime is the key.

This kind of adaptive controller is much more robust than using an identification technique that

Tuning trade offs: fast response or robustness

depends on normal process noise. Attempting to identify deadtime using a least-squares fit or some other modeling method that looks at normal process noise can be subject to gross modeling errors with disturbances. Identification techniques relying on setpoint changes, however, are accurate.

Model predictive

In a model-predictive controller the user sets a desired speed of response—the first order response time to setpoint desired.

The goal of the model predictive controller is to match the setpoint response to a first order time constant (or lag time) entered. Response is first delayed by the process deadtime. The blue line (in Fig. 1) shows the response using a model-predictive controller with a speed of response adjusted to be the similar robustness as the PI.

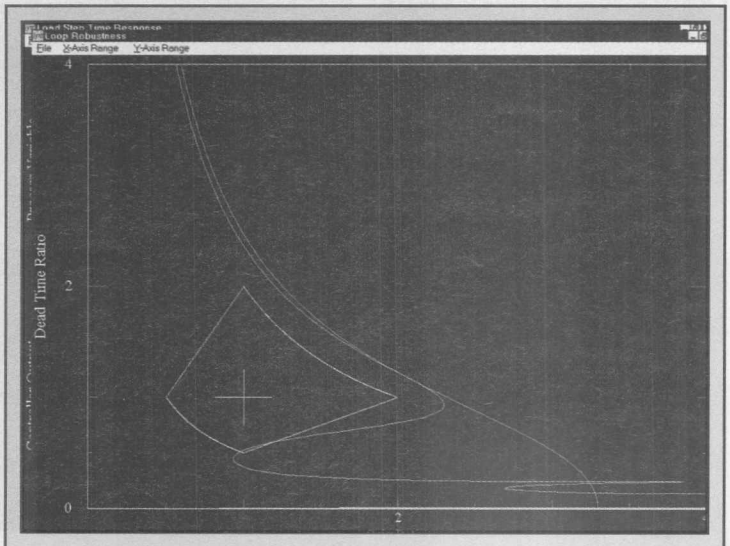


Fig. 2: At the cross, within the stable region, the gain and delay ratios are equal to one, and process gain and deadtime are at the tuned process values.

Robustness is the other side of the story. There is always a trade off between fast response and robustness or sensitivity to process changes. Robustness plots easily show this tradeoff. They show how sensitive (or robust) the loop is to process gain or process deadtime changes. The plot has two axes:

- Gain ratio = (process gain)/(process gain to which the controller was tuned);
- Delay ratio = (process deadtime)/(process deadtime to which the controller was tuned).

In the second screen capture (Fig. 2), the plot has regions of stability and instability. The red and blue lines on the robustness plot are the limit of stability for PI and model- predictive controllers. To the right and above the solid lines (higher gain and delay ratios) the closed-loop process is unstable. To the left and below the solid lines, the closed-loop system is stable. The cross represents the point where both the gain and delay ratios are equal to one. In other words, the assumed process deadtime and the actual deadtime are identical at the cross, as are the assumed process gain and actual process gain.

Generally, a safety factor or divisor of 2 is "reasonable" for a loop. These points are represented by the vertices of the blue line "box" in the robustness plot. It is a design aid. To achieve practical system stability, the limit of stability line should be outside the "box." The vertices are connected by lines that are straight on a log-log plot.

In this example, for either PI or model-predictive controller, if the process gain were to increase by a factor of 2.3, the loop would be unstable. Start at the white cross and move horizontally to the right. Where the stability lines intersect, the gain ratio is about 2.3.

Another example that works for either controller is if the deadtime were to increase by 2.4. Starting at the cross and moving straight up into the stability lines, the deadtime ratio is about 2.4. At this point the loop would again be at the verge of stability.

Counter-intuitive result

A third example that applies to the model- predictive controller is valid only if the process deadtime were to decrease. Again start at the cross and move straight down until smashing into the blue line. At this point the deadtime ratio is about 0.5. The loop with the model-predictive controller goes unstable with deadtime *decrease*.

Intuitively, like all controllers, the model- predictive becomes unstable with a large enough increase in the process deadtime. But, counter to intuition and the behavior of a PI, it also goes unstable when the process deadtime falls.

A PI controller is simple, familiar, and does a great job controlling processes with large deadtimes—simply set the gain and integral time as a factor of the process gain and deadtime. Although a model-predictive controller may perform slightly better, it suffers from poor robustness and requires extensive training for operations personnel. □

John Gerry, P.E., ceo and president of ExperTune (Hubertus, Wis.), has an MS Degree in Chemical Engineering, with experience at Eastman Kodak, Eli Lilly, S.C. Johnson, and The Foxboro Co. Simulations and figures were created using the ExperTune Loop Simulator.

For more information, Circle 225 or visit www.controleng.com/info.

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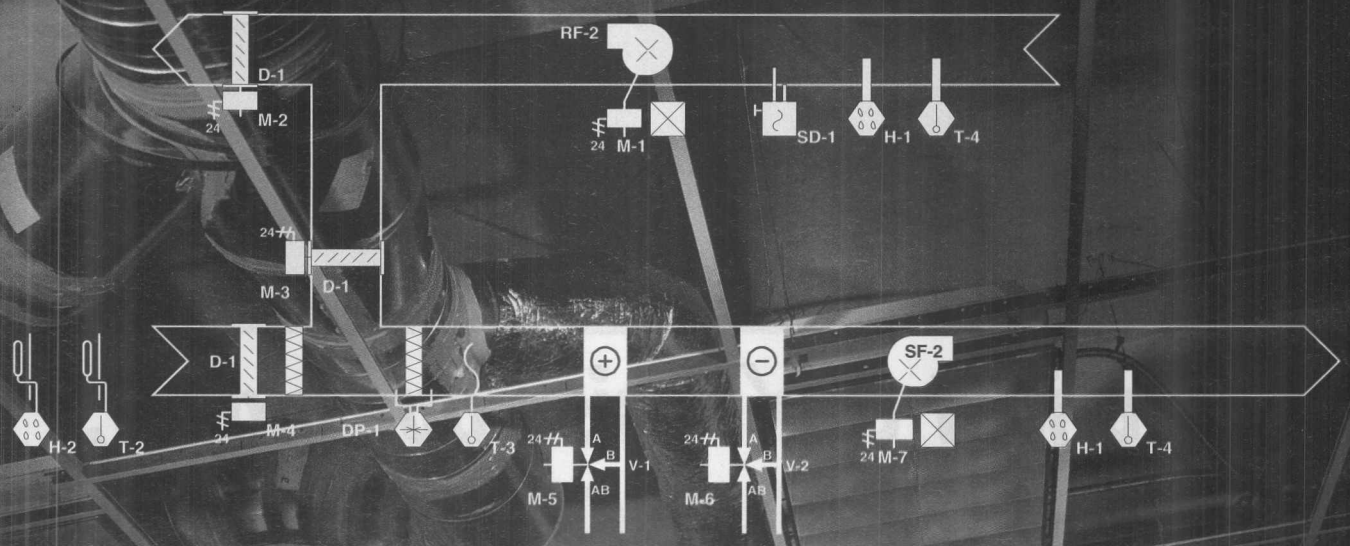
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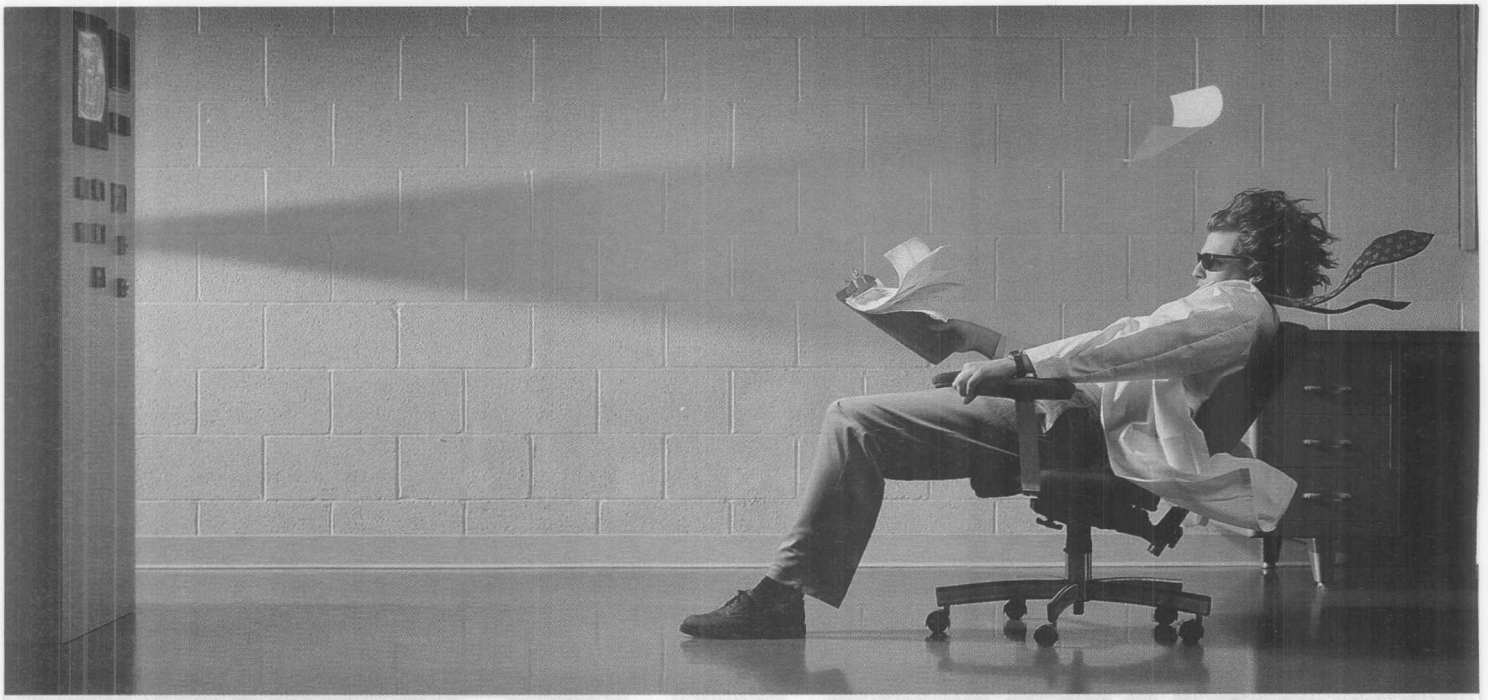
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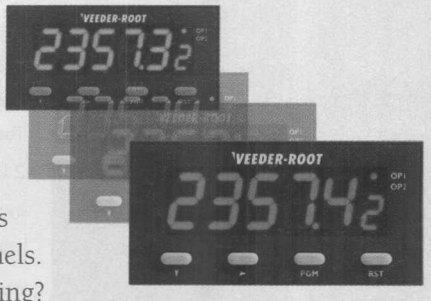
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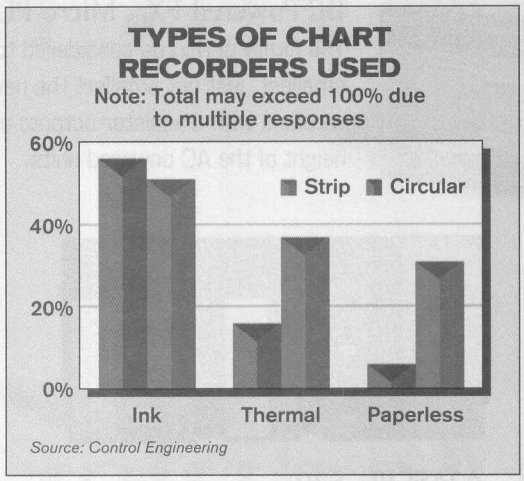
PRODUCT FOCUS
Recorders

Recorders Offer Something for Everybody

What functionality and/or features are today's recorder users seeking? How are they applying recorders? Are paperless recorders replacing traditional paper recorders? Are ink recorders more popular than thermal recorders? Do people order more single-channel than multichannel recorders?

To find out the answers to these and other questions, *Control Engineering* conducted original market research—a random sampling of 1,500 readers—about the today's recorder marketplace. To balance these user survey responses, several recorder manufacturers were contacted, as well.

A total of 330 replied to the questionnaires, representing a 22% response rate. Due to the versatility and applicability of recorders, many respondents replied to more than one choice in a category, so, many percentages reported will exceed 100%.



TRENDS IN RECORDERS

- Recorders
- Communications
- Paper vs. Paperless
- Multiple-channels replace single-channel models

Figure 1: (left) Ink recorders lead the market in both strip and circular chart recorders.

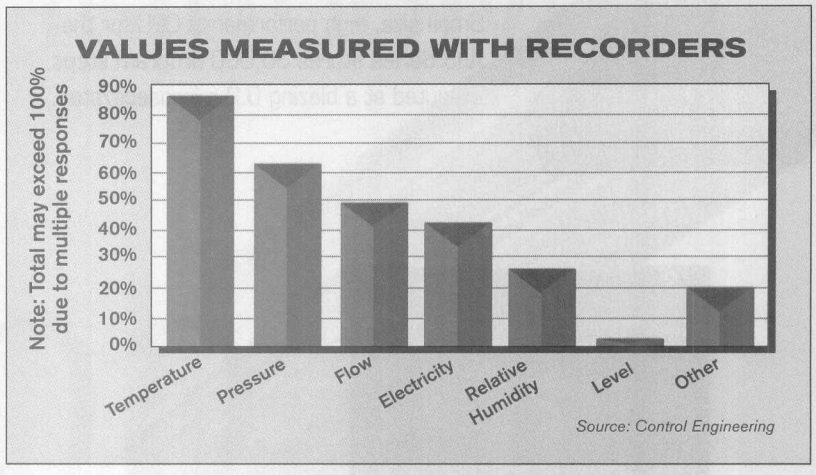


Figure 2: (above) Temperature is the most frequently measured and recorded process variable.

Results: Ink ahead

Responses received show that ink recorders still comprise the majority of recorders in use, with circular recorders, once the dominant form of recorders, only 5% ahead of strip-chart recorders (see Figure 1).

"Strip chart recording systems have been used almost exclusively in the industrial and process control environment as long-term recorders," said Mark Kerchenski, product marketing manager, Gould Instrument Systems (Valley View, O.). He adds, "The frequency response of the strip chart recorder is relatively slow. Maximum response is about 0.33 sec. at 99% full scale."

"Circular chart recorders tend to be batch oriented. That is, users are interested in a process record over a specific period. This period may be the production of a batch of product or a specific time such as a shift, day, or week," reports John Keenan, Measurement and Control Marketing Group, Honeywell IAC (Phoenix, Ariz.). He continues, "Circular chart recorders have been the most resistant to replacement by alternative technologies because of their relatively low cost and ability to produce a very specific record."

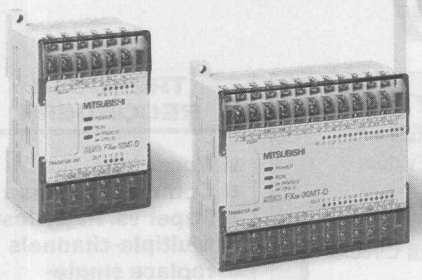
Top signals: temperature, pressure

According to Gould's Mr. Kerchenski, 'Low-frequency process recorders cover the spectrum of dc to 5 Hz and use felt tip, thermal stylus, or ink jet writing techniques." Respondents to *CE*'s survey reported that temperature is still the most-measured process variable; 24% ahead of pressure (Figure 2). Hence, it comes as no surprise *CE*'s survey respondents reported that the types of signals measured most often are from thermocouples and RTDs; in first and third places respectively; values well within Mr. Kerchenski's previous definition.

Continuous and batch applications

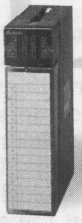
Thirty-five percent of respondents said their primary applications involve continuous processing exclusively. Eighteen percent of primary applications are exclusively batch processes.

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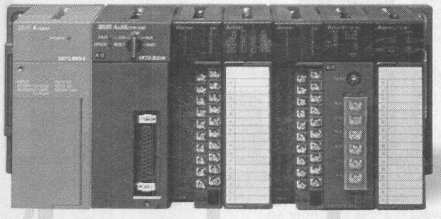
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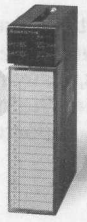
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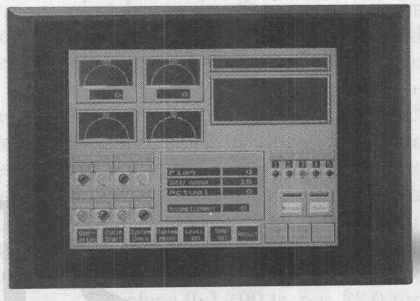


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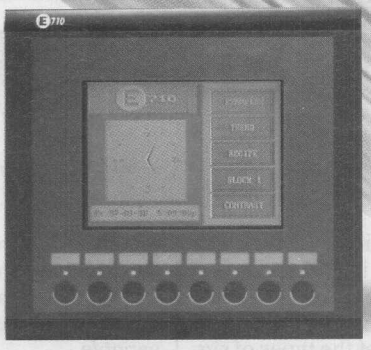


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Another 20.3% said that primary applications are split more or less equally between continuous and batch processes. Discrete applications accounted for only 7.3% of the replies (Figure 3).

Apparently, most signals received at a recorder are already conditioned prior to arrival—only 8.9% (of respondents expressing definite purchasing preferences) selected plug-in signal conditioners (Figure 4). This makes sense since most signals recorded are in some sort of engineering units, such as gallons per minute, °C, pounds per square inch, etc.

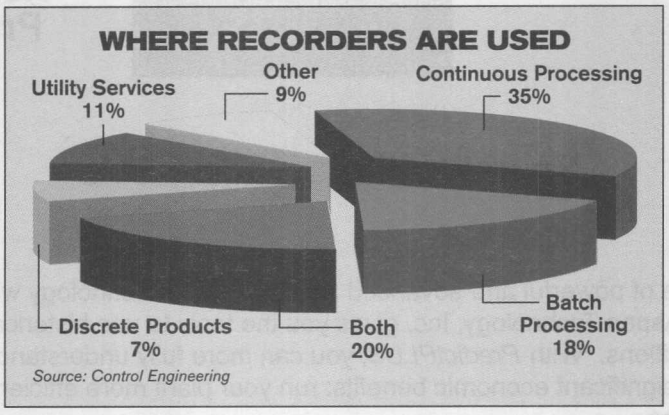


Figure 3: Seventy-three percent of recorders are used in continuous processing, batch processing applications, or both.

According to Scott Lynch, marketing communications manager at ABB Instrumentation Inc. (West Henrietta, N.Y.), "Complicated math functions (*e.g.*, mass flow or relative humidity) and calculations can now be done within the recorder. Even when trying to measure a nonlinear vessel, recorders today can be set up with custom inputs, where X and Y coordinates can be plotted out so that the input can be correctly measured and recorded."

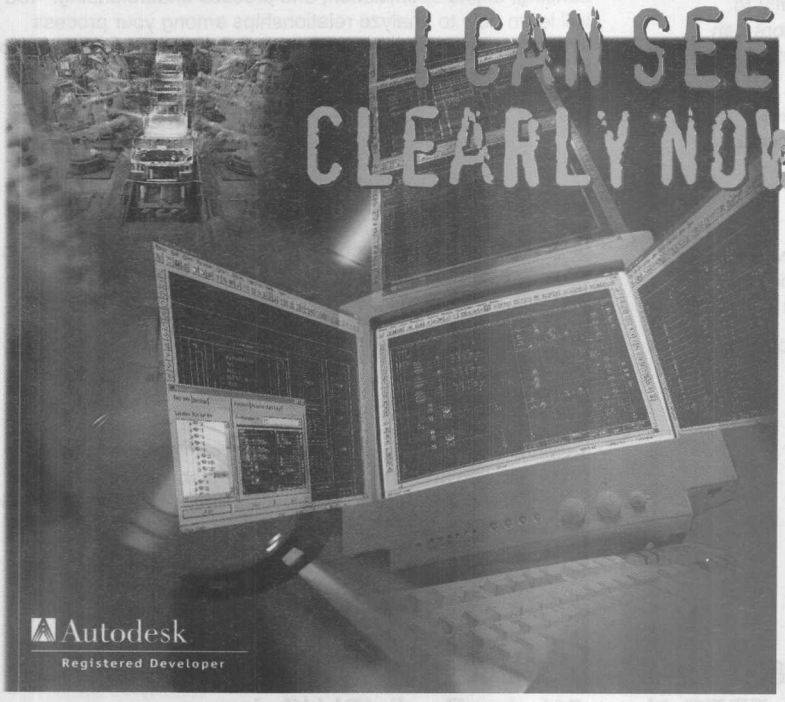
Need for multichannel recorders

Richard Veit, vice president, Eurotherm Chessell (Newton, Pa.) notes, "Not too many years ago, one recorder was necessary to print each channel of data. That consumed not only miles of chart paper, but an incredible amount of control panel space. To meet this challenge, Chessell is producing multichannel and multifunction recorders that can handle nearly 100 data channels; eliminating a great deal of paper usage and panel area." *CE*'s study bears this out. Of respondents voicing a preference for certain features, 40% indicated a need for recorders with five or more data input channels (Figure 4).

Paper vs. paperless

Mr. Veit points out, "During the last decade, we have seen an evolution—some may call it a revolution—in the amount and types of data needed to control today's ever-more complex processes. Users need and want to do much more in managing, refining, and fine-tuning

(continued on p. 155)



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You can now take advantage of powerful and advanced neural network technology with *NeuralWorks PredictPLUS*. This software product from Aspen Technology, Inc. gives you the tools to use historical plant data to predict various properties and process conditions. With *PredictPLUS*, you can more fully understand your plant's processes and use that information to gain significant economic benefits: run your plant more efficiently, predict process performance, and reduce down time.

PredictPLUS is designed for data-centric process modeling and offline optimization. In addition, it is highly automated, integrates directly into Microsoft Excel and produces models you can use directly or integrate into other applications such as ASPEN PLUS, SPEEDUP, and RT-OPT.

Applications

Back-up Inferential Sensors: Reduce unscheduled maintenance costs by estimating process properties from process variables. Identify sensor failures before they become critical so maintenance can be scheduled. Replace faulty sensors taken off-line for maintenance with back-up inferential (software) sensors.

Operator Advisor: Respond more rapidly and consistently to process disturbances and changing demands. Operators can take appropriate control actions to achieve key process objectives.

Process Variable Analysis: Determine important process variables and derive the correlations linking them to process properties and process performance.

Why You Should Use PredictPLUS

PredictPLUS is ideal for process and control engineers who need the advanced technology of neural networks to improve their plant's performance. Specifically, *PredictPLUS* can:

- Help you better understand the specifics of your process.
- Improve your process to reduce the amount of off-specification product produced.
- Offer you low-cost alternatives to expensive sensor equipment.
- Provide a means of detecting failed, or soon-to-fail, equipment before it becomes a problem.

Training

Not familiar with the technology? *Applying Neural Networks in the Process Industries* is a practical, application-oriented course in applying *PredictPLUS* in the process industries. The course introduces neural networks, and develops a methodology for applying *PredictPLUS* to various problems including inferential sensing, offline optimization, and process understanding. You will learn how to analyze relationships among your process variables, how to build neural network process models, and how to use those models to understand and improve your process.

Services

In addition to direct support for *PredictPLUS*, AspenTech can help you create your own custom applications with services that include application design, development and deployment.

For More Information

To learn more about how *PredictPLUS* can provide rapid real-time modeling and optimization of your plant's processes, contact the AspenTech Neural Net Business Unit at 1-800-635-2442, International 1 (412) 787-8222. Fax 1 (412) 787-8220. Email sales@aspentech.com.

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For information circle **91**

PRODUCT FOCUS
Recorders

their production. In process control, we are seeing a tremendously increasing demand for more process information and data. Data need to be available upon demand—both in real time and retrospectively—but the need for printed documentation of all data has been changing. Because so many data are, or need to be, available, it is just too unwieldy to print them all."

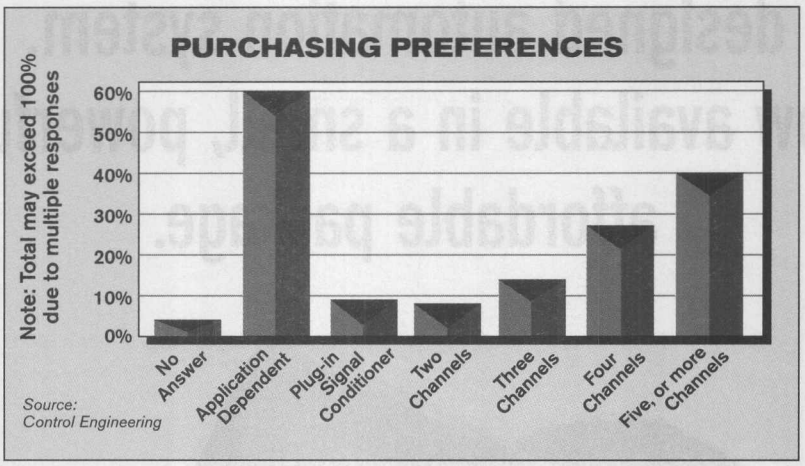


Figure 4: Most recorders are purchased to suit specific applications.

Bruce Zavodny, business support manager, Recorders and Data Acquisition Instruments at Yokogawa Industrial Automation (Newnan, Ga.) reports, "The long-predicted switch from paper-based strip chart recording to non-paper means of gathering and presenting process information is well underway. While paper-based recording has not disappeared, the last few years have seen significant movement toward videographic 'recording' and PC- or monitor-based data acquisition." He attributes this change to the fact that, "Process users have become more trusting of computer-oriented control, monitoring, and display capabilities. Now, many users want much of the same information they previously captured on recorder paper viewable on an operator display. The information often is not only to be viewable locally by the operator, but is also increasingly being distributed over Ethernet-based networks.

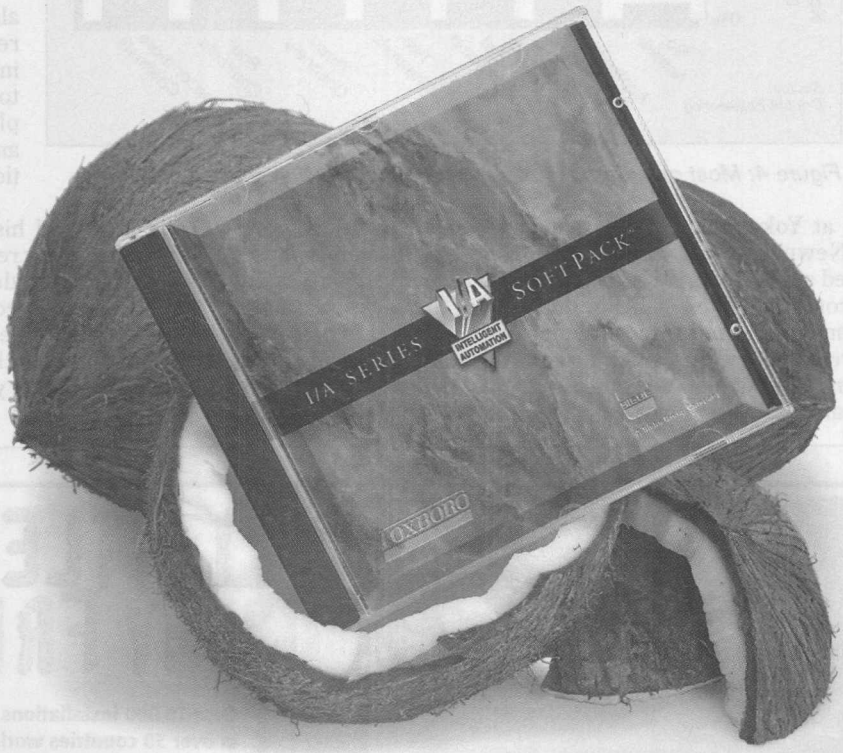
"Additionally," Mr. Zavodny says, "Users also want to be able to readily view historical information, and be able to simultaneously display both the present and historical information."

So the need for up-to-the-minute and historical process information is driving recorder manufacturers to produce models that can accept several inputs, record and process the signals, and store the values on some sort of media other than just paper. While regulatory agencies current-

(continued on p. 157)



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For information circle **93**

ly drive the need for companies to keep paper records, here, too, things are expected to change as regulatory agencies learn to trust electronic storage media. Paper recorders may never go away. After all, typewriters are still made. □

Was this article...
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Videographic 'Strip Chart' Recorder

Indianapolis, Ind.—The VideoGraphic Recorder (VGR) product line comes in two different models (display width and case size), and can accommodate from 4 to 96 signal measurements. Angus claims that an unlimited number of VGRs can be connected and controlled with Angus' VGRNet for Windows PC software. VGRNet lets the instruments share data on any Microsoft Windows-compatible network operating system.
Angus Electronics Co. **Circle 284**

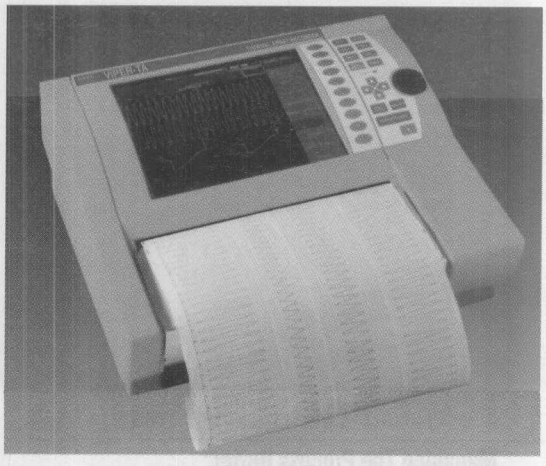
Networking Videographic Recorder

Newnan, Ga.—The display of the VR Series of videographic recorder has been configured to emulate the Yokogawa μR1000 strip chart recorder. Features include easy-to-read digital display plus analog trend; easy-to-read videographic chart with numeric printing of critical information; English prompted programming and setup; color traces, automatic data-to-floppy transfer; multiple password protection; and others.
Yokogawa Industrial Automation
Circle 280

Paperless Recorder

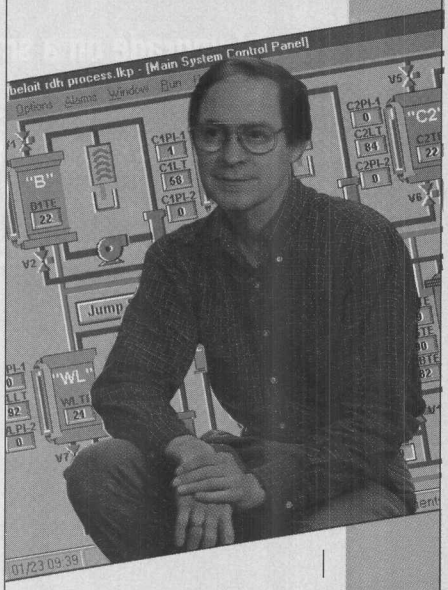
Stamford, Conn.—Omega VR100 paperless recorder series offers real-time display of data on a color LCD and data storage on a standard 3.5-in. floppy disk. For enhanced reliability and performance, flash memory holds data for a single download when the floppy is inserted. The unit measures four or six channels from V dc, RTD, or thermocouple sources.
Omega Engineering **Circle 281**
(continued on p. 159)

Recorder Captures Transients



Valley View, O.—Viper TA thermal array recorder offers simultaneous measurement and recording of four, eight, or 16 channels of input signals from a varietyof externalsensors. Features include signal conditioning, monitor, transient capture,store-to-nonvolatile media, chart output, and communications interfaces.
Gould Instrument Systems Inc.
Circle 287

HMI Software



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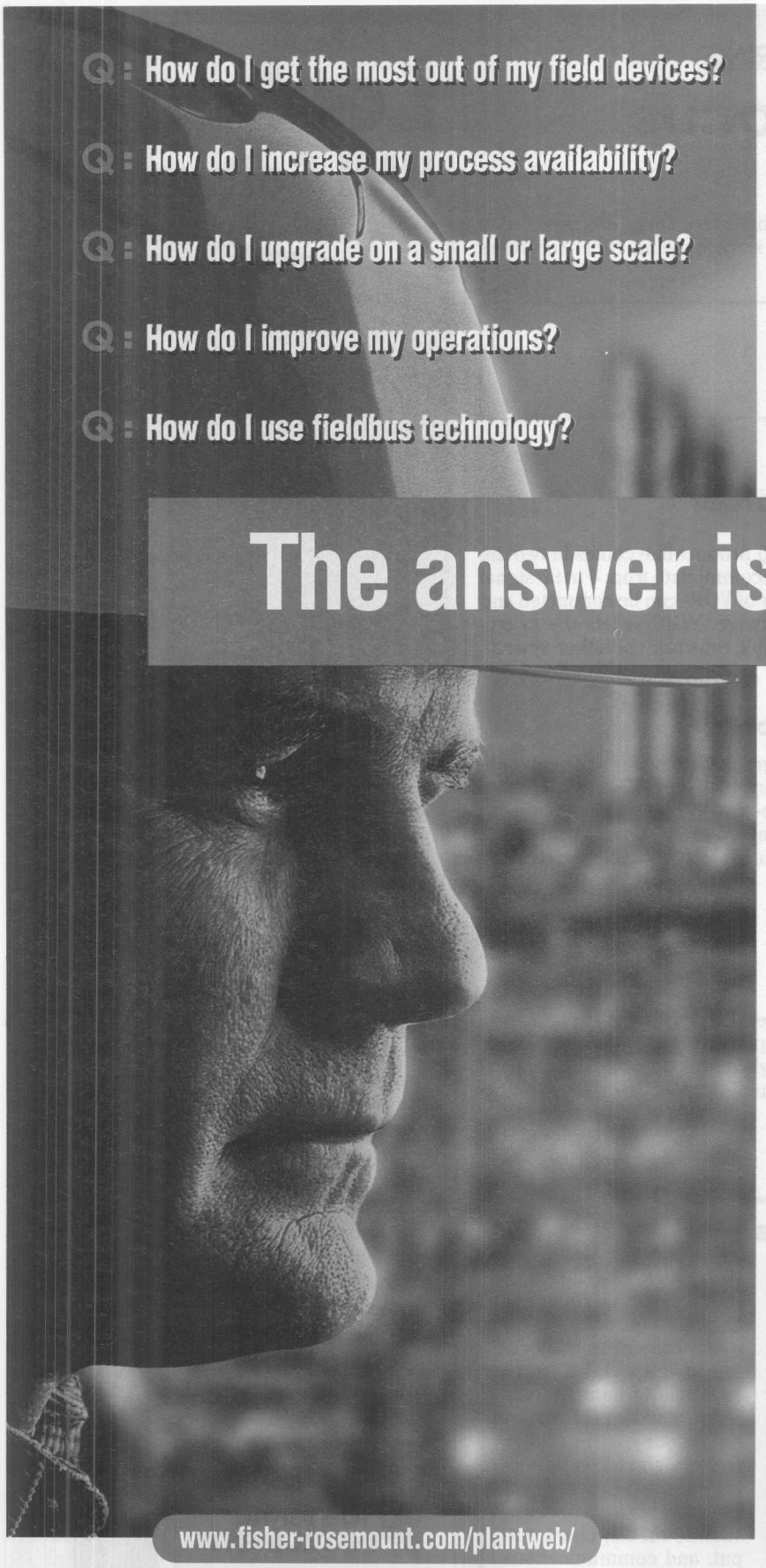
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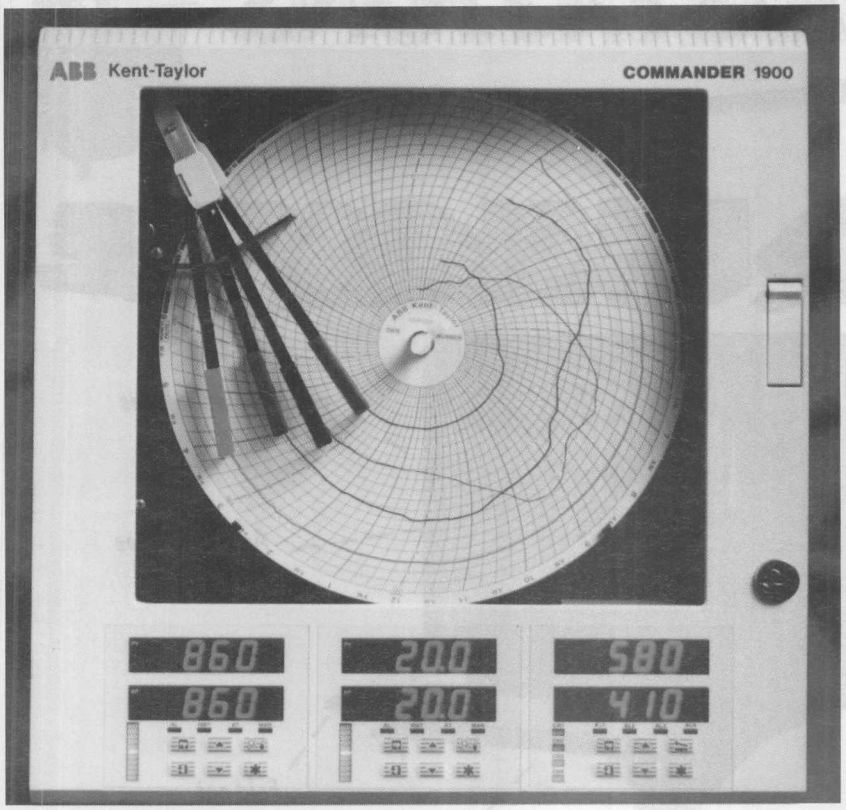
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For information circle 95

PRODUCT FOCUS
Recorders



Circular Controller/Recorder

Rochester, N.Y.—Commander 1900 circular chart controller/recorder features NEMA 4X protection, 0.1% input and output accuracy, retransmission, up to four pens and two controllers, transmitter power supply, fully isolated I/O points, two digital inputs, one alarm relay per channel, and up to 12 relay outputs.

ABB Instrumentation **Circle 288**

Input Up to 32 Channels

West Warwick, R.I.—K2 can record up to 32 channels of data from a variety of inputs, display waveforms in real-time, acquire data to RAM, internal or external hard drives, or floppy drive, and analyze captured data. All recorder functions can be controlled remotely as well as a variety of interfaces including RS-233, GPIB, SCSI, and high-speed parallel communication protocols.

Astro-Med Inc. **Circle 282**

Microprocessor-Based Circular Recorder

Kingwood, Tex.—The microprocessor-based CCR6000 circular chart recorder is available in one- or two-pen configurations. Both models trace on a 10-in. dia. chart and indicate process variables on a digital display.

Westronics **Circle 283**

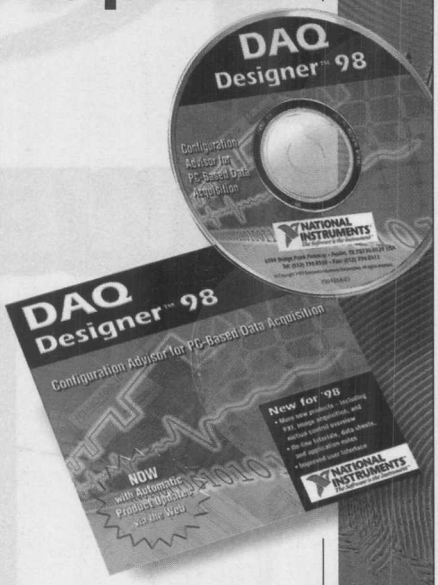
Recorder with Optical Disk Storage

San Fernando, Calif.—Model TA220-3424 digital oscillographic recorder comes with a phase change optical disk recorder offering 650 Mbytes of read-write operation on removable memory media. The disks can be redistributed, edited, or rewritten as needed. Up to 24 channels can be accommodated from a variety of signal sources.

Soltec Corp. **Circle 285**

(continued on p. 161)

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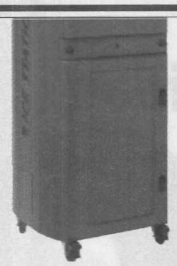
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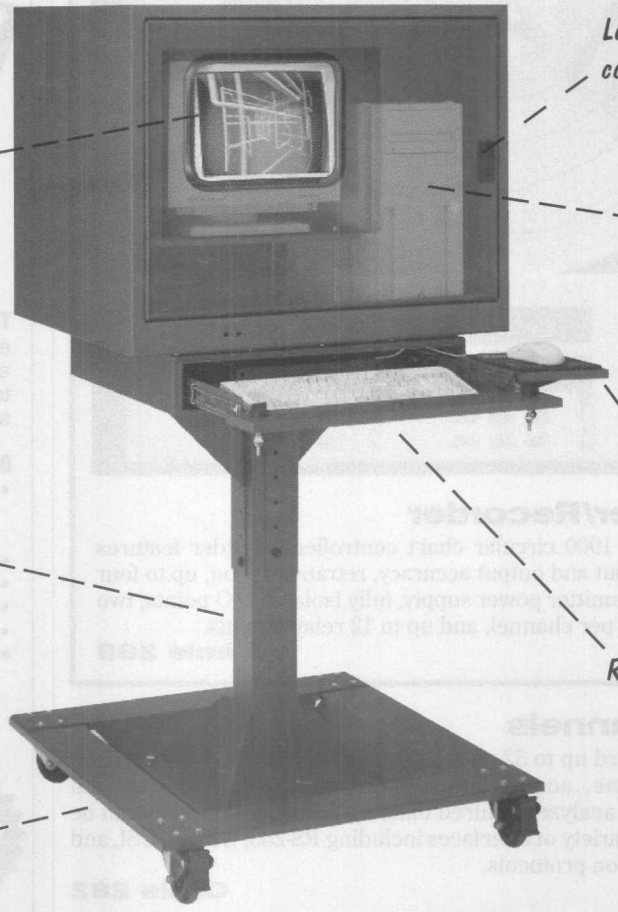
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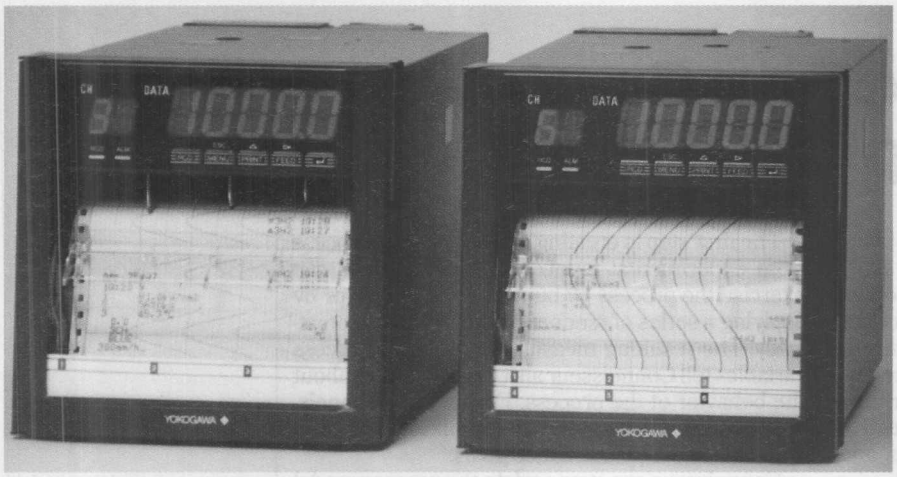
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PRODUCT FOCUS
Recorders

100-mm Recorder Has CE Marking



Newnan, Ga.—The SR1000 line features CE marking, an oversized LED display, date and time printing on the chart and a different color for each channel. These recorders are available in one-, two-, and three-pen versions, or in a 6-point dot matrix printing model.

Yokogawa Corp. of America **Circle 290**

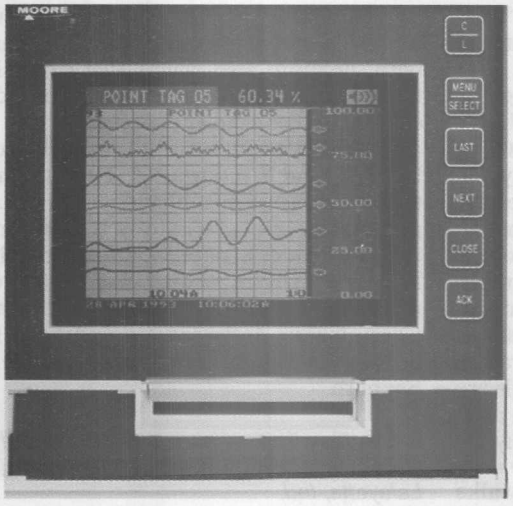
Recorder has Pens and Thermal Print Head

Michigan City, Ind.—The Series 1600R 100 mm strip chart indicating recorder includes a large 20-character fluorescent display showing the input value of each of the four channels and user-friendly prompts for ease of programming. In addition to the four color-coded analog pens, the 1600R features a thermal print head that prints the time, date, and other vital information right on the chart. An RS-232 port is standard and accessible from the front panel. Programming may also be accomplished via the serial port. Optional features include a backlit color LCD bargraph display showing the status of all four channels at a glance, and RS-422/485 ports. Programmed parameters are stored in EEPROM to prevent loss during power failures.

Love Controls Div., Dwyer Instruments **Circle 291**

Preconfigured Trend-Style Displays

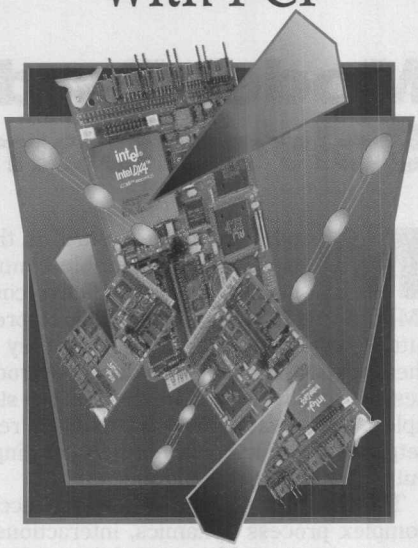
Spring House, Pa.—Model 363 ViewPac recorder combines trend-style displays and data acquisition functions in one instrument for real-time local trending at reduced maintenance and configuration costs. To reduce configuration time, ViewPac uses preconfigured function blocks for control strategy configuration. Front-panel pushbuttons eliminate the need for separate, hand-held or PC-based devices. Features include local data storage, calculation, characterization, split-screen trend windows, zooming, alarm summaries, and others.



Moore Products Co. **Circle 286**

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SOFTWARE REVIEW

Model-Predictive Controller Solves Complex Problems

Model-predictive control is the latest trend in multivariable control technology. Model-predictive controllers (MPCs) use mathematical models to predict the future behavior of the processes they control, then adjust their control efforts to produce the desired results. MPCs are designed to steer multiple process variables towards their respective setpoints while keeping both process inputs and outputs within specified ranges.

This is no easy task. MPCs must account for complex process dynamics, interactions among the process variables, and delays between the application of a control effort and its effect on the process variables. Although several MPCs are now available as commercial software packages, no single technique has yet emerged as the definitive solution to all of these problems.

The Foxboro Company (Foxboro, Mass.) has entered the fray with Connoisseur, an MPC software package developed by Predictive Control Ltd. (Foxboro's sister company in Northwich, U.K.). Connoisseur was designed to make model-predictive control not only practical, but accessible to anyone with basic process engineering knowledge.

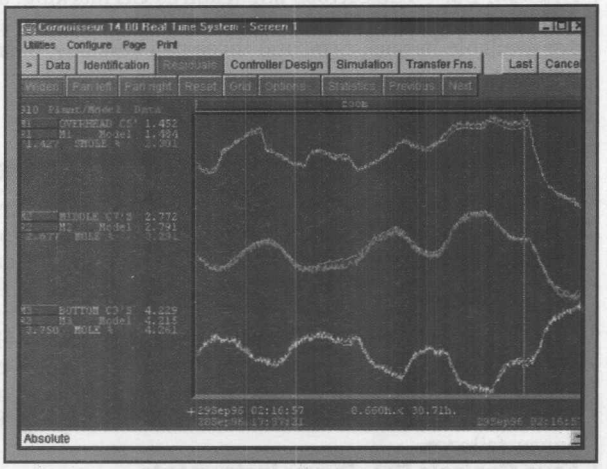
This too is a monumental undertaking. The mathematics behind an MPC is much more complex than simple proportional, integral, and derivative calculations. Connoisseur uses a "linear time-series sampled-data model with a multi-input, multi-output structure" just to quantify the behavior of the process. Customizing the generic model for a particular process involves an "unbiased recursive least squares parameter identification" technique.

Then there's the problem of optimizing the process's setpoints. An MPC generally has a choice of where each process variable should be maintained within a range constrained by the physical limits of the process. Certain choices will yield better results than others, depending on the behavior of the process and the placement of the constraints. Connoisseur uses the process model and a linear programming algorithm to search for the setpoints that will minimize the overall cost of operation without violating any of the constraints.

Fortunately, most of those technical details are handled, more or less, automatically. Users need to know enough about their process to specify the order of its model, its settling time, and the sampling interval. Otherwise, Connoisseur walks users through the configuration procedures without the need for extensive control theory.

The first step is creating a model for the process from experimental input/output data. Users can exercise the process by bumping it manually or by applying a series of random perturbations automatically. The resulting measurements of the process variables tell Connoisseur all it needs to know about the behavior of the process. From there, Connoisseur can create the specific controller required to meet the user's performance goals.

Connoisseur can even update the process model automatically if subsequent measurements show that the input/output relationships have changed. This feature allows the controller to adapt to the long-term effects of uncontrollable influences such as equipment wear, fouling, or variations in ambient conditions.



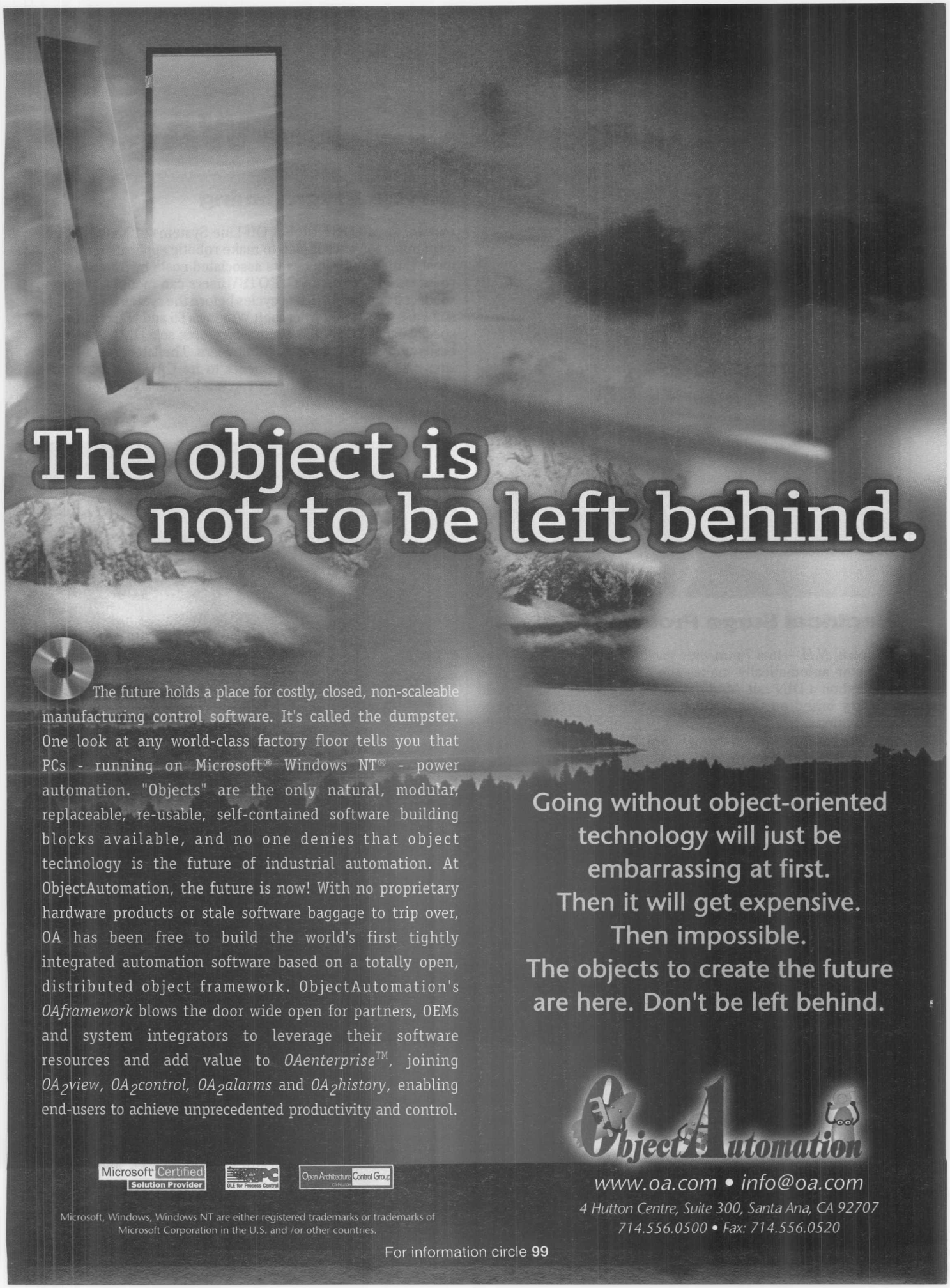
Connoisseur software was designed to make model-predictive control not only practical, but accessible to anyone with basic process engineering knowledge.

The MPC that Connoisseur produces as a result of these operations may or may not be the ideal controller for any given process. Judging from what I've seen, however, a Connoisseur controller should be particularly effective for handling processes subject to long deadtime, unmeasured disturbances, or both. Foxboro also claims that Connoisseur is faster than competing MPC products and is more economical for smaller processes.

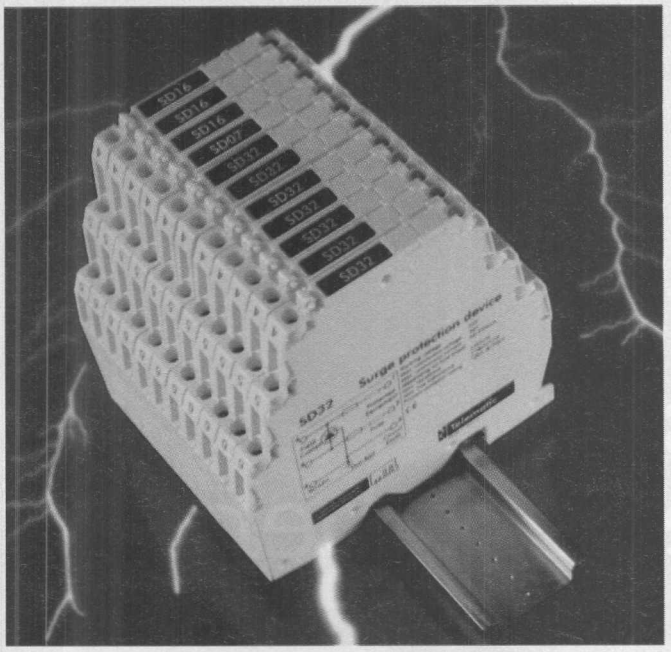
Connoisseur is currently available on DEC, HP, Sun, and Windows NT. The minimum configuration for a PC implementation is a Pentium processor running Windows NT 4.0 (or better), SVGA graphics capability, at least 64 MBytes of RAM and 2 GBytes of disk space, a network communications card, and a Postscript printer. The Connoisseur software (including a runtime license) lists for $44,800 and is available through Foxboro.

Consulting Editor, Vance J. VanDoren, Ph.D., P.E., is president of VanDoren Industries, West Lafayette, Ind.

For more information on Connoisseur, Circle 310 or visit www.controleng.com/info.


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PRODUCTS & SOFTWARE



Electrical Surge Protection

Hampton, N.H.—In a 7-mm wide package, the SD Series surge protector automatically makes the ground connection when installed on a DIN rail. Modules in the SD Series use a hybrid circuitry based on Gas Discharge Tube (GDT)/surge diode combinations. The SD Series is available in a wide range of voltage ratings for processes using RTDs, thermocouples, 4-20 mA loops, digital signals, shutdown systems, and fire and gas detection systems. The device is built in an ISO 9000 certified facility and is covered by a three year warranty.

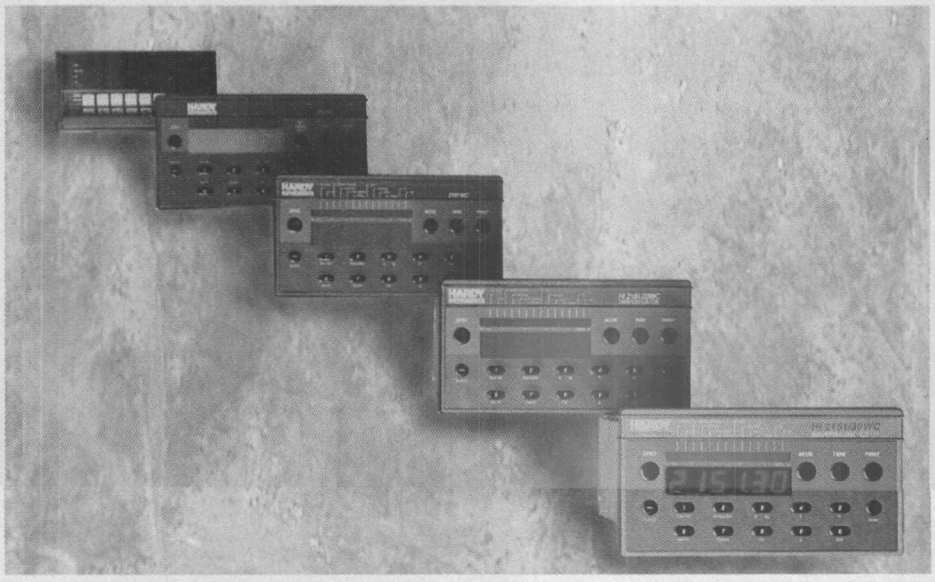
MTL Inc. **Circle 430**

Off-line Programming

Dayton, O.—ROTSY (Robot Off-Line Systems of Yaskawa) programming software is said to make robotic application development simple and reduces its associated costs by implementing robot simulation on a PC. ROTSY users can model a proposed robot cell and perform test cycles before the system is built. The software runs under Microsoft Windows 95 and NT, requires no special hardware, and has simple features so a HMI interface is easily understood, even by robot users. The latest release, Version 4.2., includes enhancements to its CAD-based features, including 3-D design so users can model and layout robot cells with peripheral equipment.

Motoman Inc. **Circle 436**





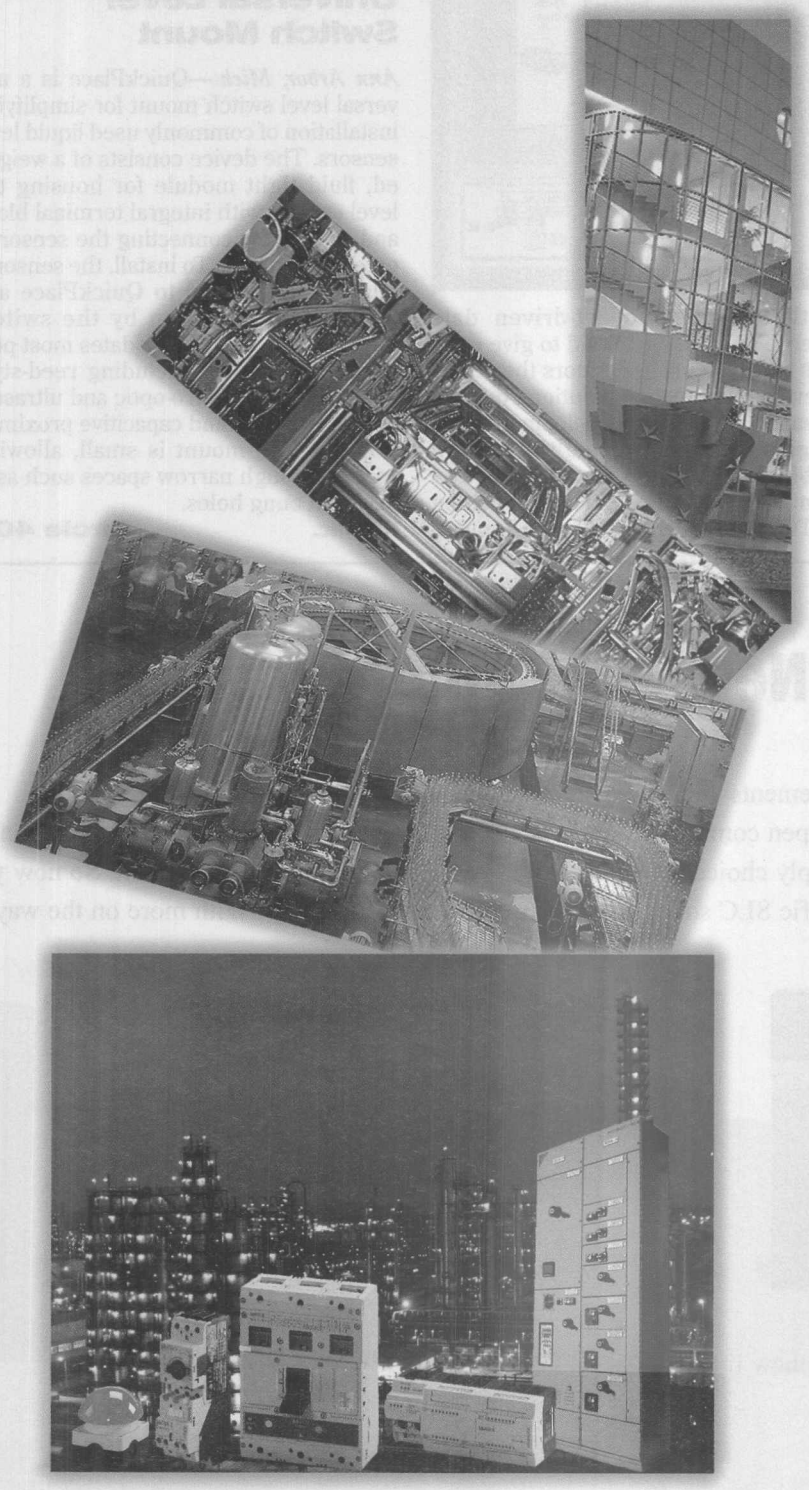
Weight Controller

San Diego, Calif.—Hardy Instruments releases the new HI 2151/30WC multipurpose weight controller with Integrated Technician (IT). Integrated Technician provides built-in system diagnostics to continuously monitor the system for failures and notifies the operator if out of tolerance. Individual weighing system components can be isolated when used with the IT Junction Box. The HI 2151/30WC comes with a selectable RS-232, 422, or 485 serial port and Hardy Link local area network for multidrop configurations. Optional interfaces include Allen-Bradley Remote I/O, analog, and BCD.

Hardy Instruments Inc.
Circle 416

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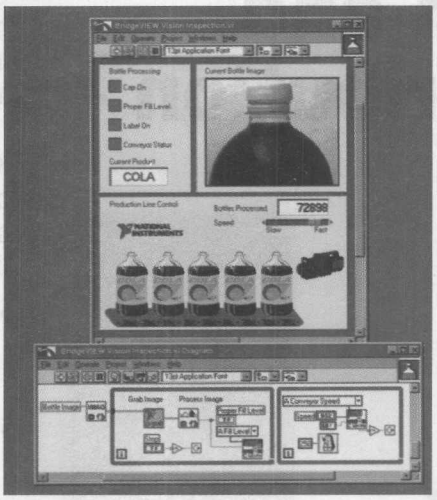
Active-X/DCOM funtionality

Moraga, Calif.—New enhancements including Microsoft's DCOM (Distributed Component Object Model) and Active-X; Structured Query Language database support, and the latest Transmission Control Protocol/Internet Protocol networking functions of Windows Sockets 2.0 specifications have been added to AIMAX for Enterprise software. AIMAX for Enterprise is the latest HMI software package designed for both large- and small-scale network operations. According to the company, it is one of the first to provide Active-X and DCOM functionality on a web server.

TA Engineering Co. Inc. **Circle 450**

Simplify Industrial Automation

Austin, Tex.—BridgeView 2.0 is the latest version of a SCADA software package that combines popular software technologies and the G language of LabView,



together with an event-driven data engine. The package is said to give engineers and systems integrators the power to develop automation solutions quickly and easily. Application development technologies included are multithreading capability, full OPC client support, Active-X container, and BridgeView automation and TCP/IP server. Distributed computing tools, a translation and documentation tool, and programmatic menu bars with undo are also part of the package. The software is available for Microsoft Windows 95 and NT.

National Instruments **Circle 437**

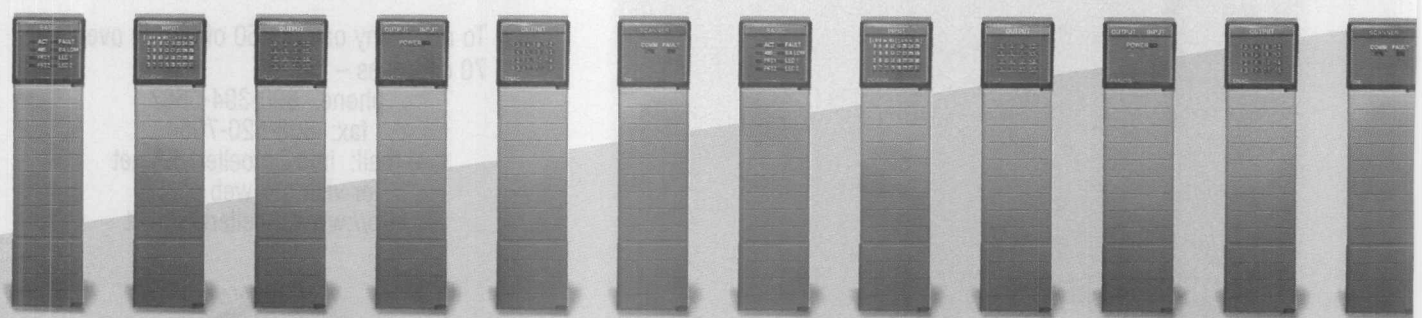
Universal Level Switch Mount

Ann Arbor, Mich.—QuickPlace is a universal level switch mount for simplifying installation of commonly used liquid level sensors. The device consists of a weighted, fluid tight module for housing the level sensor, with integral terminal block and cabling for connecting the sensor to external controls. To install, the sensor is attached and wired to QuickPlace and lowered into position by the switch-mount cable. It accommodates most popular level sensors, including reed-style float switches, electro-optic and ultrasonic level sensors, and capacitive proximity sensors. The mount is small, allowing access through narrow spaces such as 2-in. drum bung holes.

RK_2 Inc. **Circle 401**

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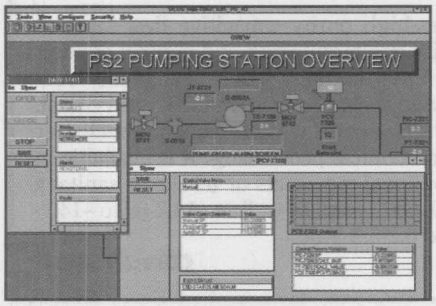
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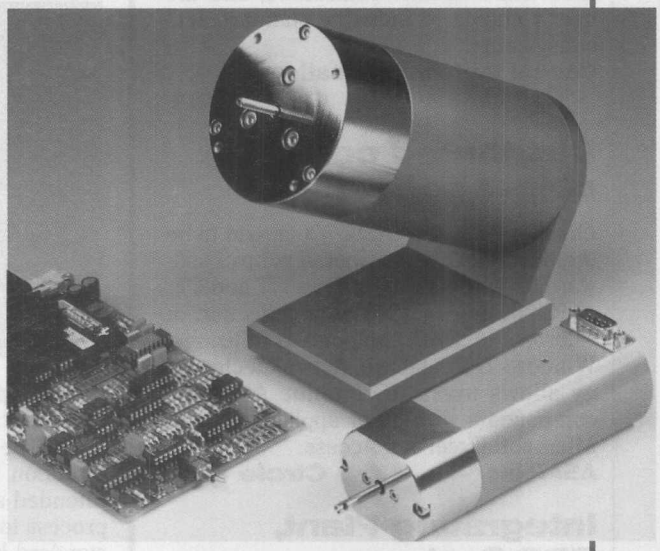
New Version Ready

Fairway, Kan.—UCOS version 3.1, pc-based control software, now includes data import/export capabilities that are said to speed system development and a number of new tools for customizing the operator interface, scripting language, and user-defined help. The release also provides enhanced hardware fault diagnostic capabilities. UCOS is a control system product which includes project development software, operator interface graphics, and real-time logic execution software. Its architecture includes PC-based

(continued on p. 168)

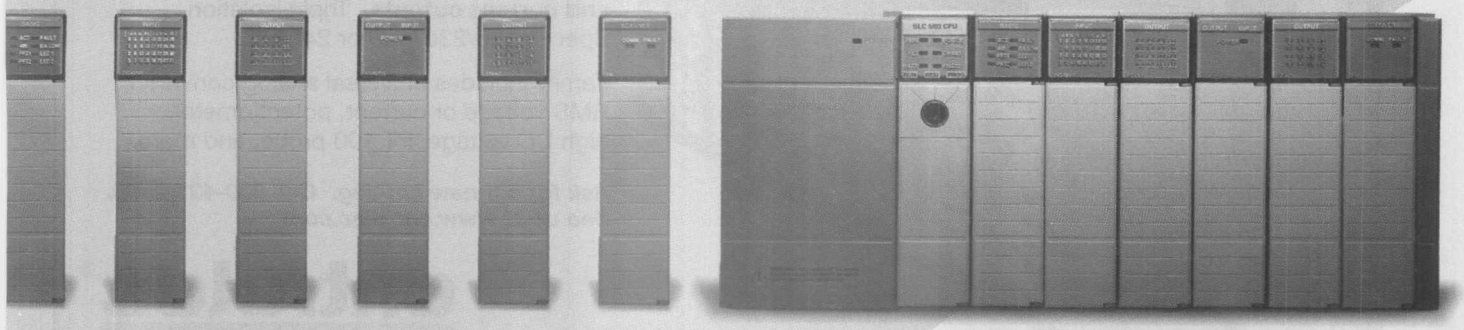


Direct Drive Linear Motors



Môtiers, Switzerland—ETEL has developed linear motors to replace classical motion control solutions such as motor-driven connecting rods, racks, or ball screws. For strokes up to 50 mm, the company provides a moving coil system which is fully integrated with slide and built-in position sensors. The sensors provide positioning repeatability of μm. Maximum acceleration is 1.6 m/sec^2 with a maximum thrust of 150 N and a bandwidth of 300 Hz. An electronic Europ card incorporates the current loop, position loop, and signal processing. Userinterface is 48 V dc with a 4 amp power supply.

ETEL SA **Circle 438**



Rockwell Automation
Allen-Bradley

For information circle **116**

engineering and operator workstations running under Microsoft Windows NT, industrial real-time controllers, and the user's choice of industry standard I/O subsystems.

Control Systems International **Circle 431**

Distributed control object software

Chagrin Falls, O.—ASIC-300 is said to be the first scalable distributed control software for Microsoft Windows NT and CE. ASIC-300 is designed as a collection of Microsoft ActiveX components utilizing a Windows NT database. ActiveX technology allows users to combine ASIC-300 components with other applications like Microsoft Excel and Access.

ASAP Inc. **Circle 419**

Integrating Plant, ERP Systems

Phoenix, Ariz.—EnterpriseBatch software allows manufacturing organizations to inte-

(continued on p. 170)

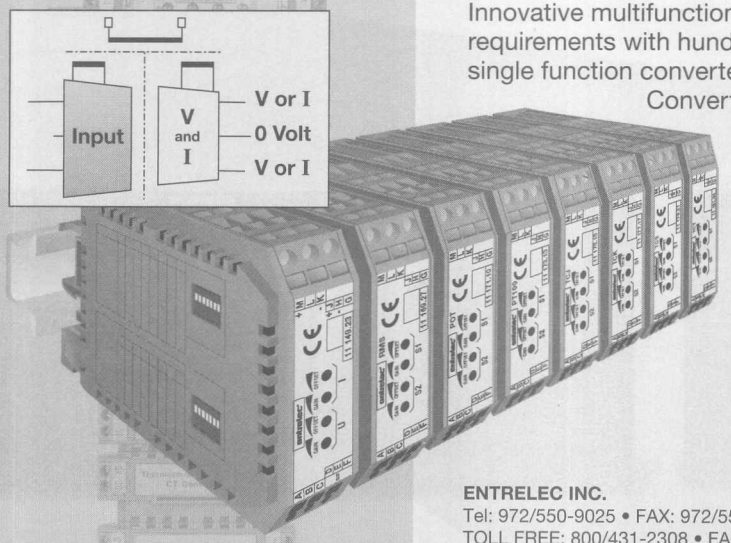
Ultra-High Purity Pressure Transducer



Boxborough, Mass.—Model 214 is an ultra-high purity capacitive flow-through pressure transducer designed for speciality gas monitoring and control applications. The device is said to be suited for environments where transducer construction integrity, purity of materials, and overall performance are critical. Intended applications include high-purity gas delivery systems, semiconductor process tools, and pharmaceutical and biotechnical processing. It is available in standard ¼-, ⅜-, and ½-in. dia. tube with optional face seals or tri-clover sanitary fittings. Pressure ranges are from 0-50 to 0-3,000 psig, as well as –14.7-50 to –14.7-3,000 psig. Available output is 4-20 mA and 0.2-5.2 V dc.

Setra Systems Inc. **Circle 454**

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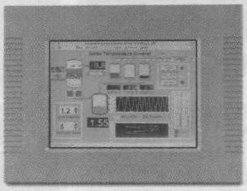
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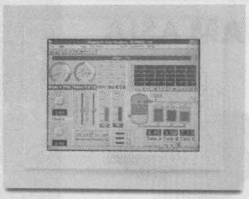
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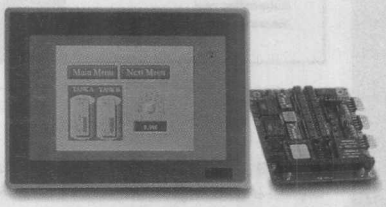
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For information circle **119**

grate the disparate information in business and plant-floor systems, using corporate recipe and formula data as a natural focal point. Unlike previously available point-to-point solutions, the software is said to enable Global 5000 organizations that have multiple control and business systems to manage production in many different sites with repeatable quality.

PID Inc. **Circle 434**

Flat panel display

Morgan Hill, Calif.—IP-1400 is an auto-sync, active matrix, thin-film-transistor (AMTFT) color LCD for industrial applications. The 14-inch flat panel sizes images to full-screen automatically and supports resolutions to 1,024 pixels x 768 lines. The IP-1400 has front panel controls and an autosensing, universal power supply. Resistive touchscreen is available in either clear or antiglare.

Iicon Corp.. **Circle 417**

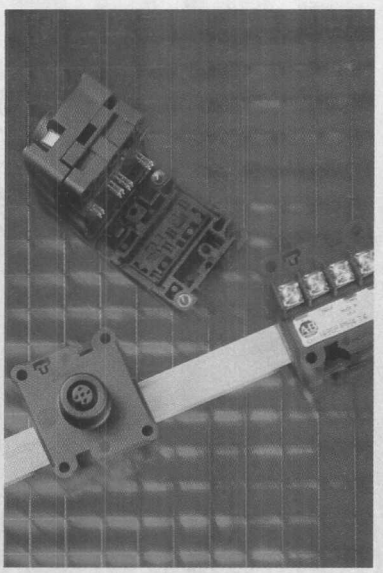
Live Data to Virtual Library

Willoughby Hills, O.—Paragon ShopDoctor Virtual Library can now bring live data to its plant-wide network that includes more than 150 types of document formats. Live data can come from any DDE server application such as RSLinx or Excel. It can also link real-time PLC data and HMI tags to MS Word documents, spreadsheets, flowcharts, drawings, and pictures. And by supporting Rockwell Software's RSPortal, this same functionality is available using TCP/IP.

Paragon Technologies Inc. **Circle 435**

(continued on p. 172)

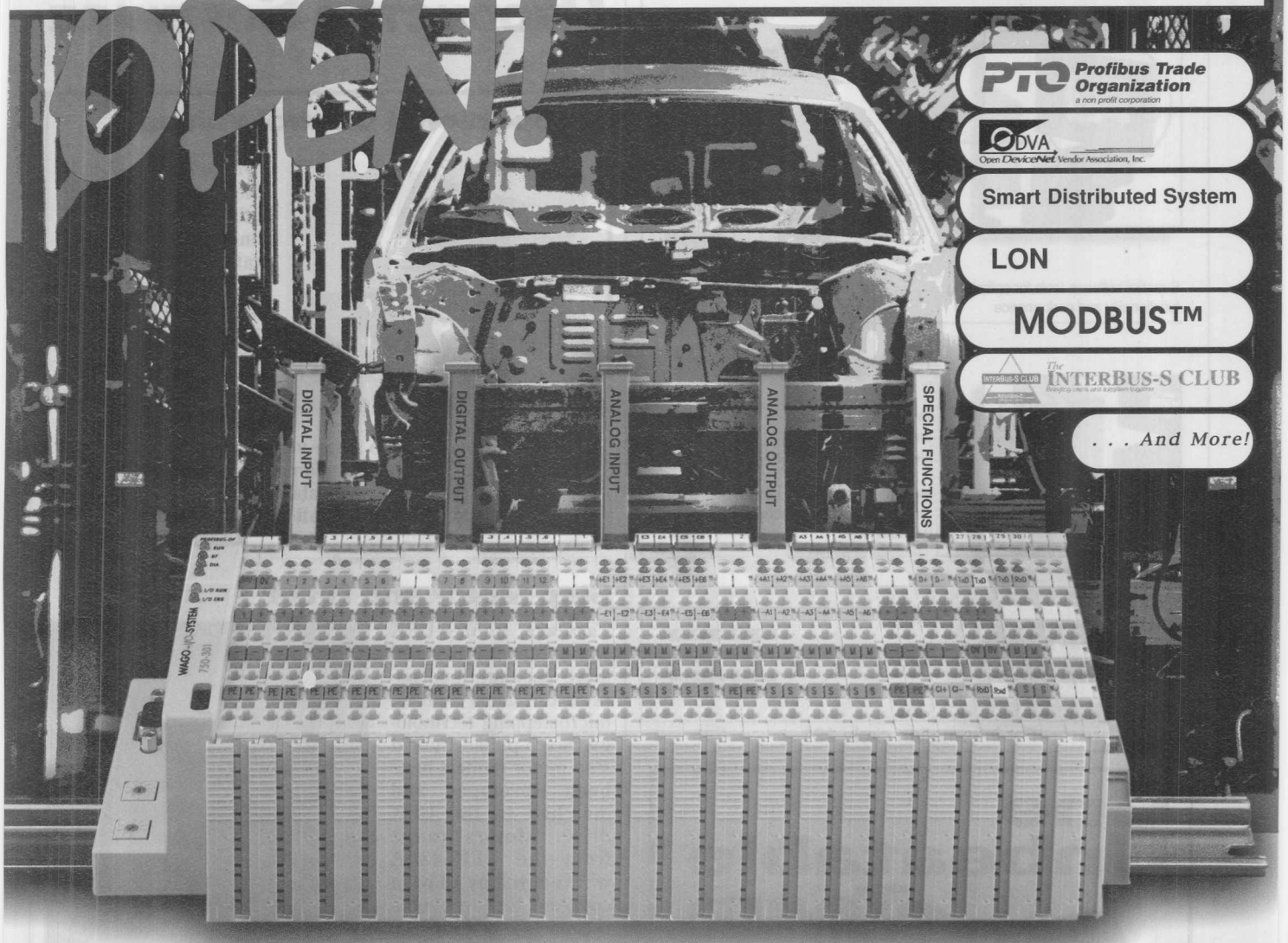
DeviceNet Cable



Milwaukee, Wis.—KwikLink flat trunk line cable and insulation displacement connectors are said to reduce material and engineering costs up to 50% while easing installation. The new four wire unshielded flat trunk line cable is more flexible than its round counterpart. A tighter bend radius allows the flat cable to fit into applications where space prohibits use of round cable. KwikLink cable supports 64 nodes with trunk length restrictions, is UL listed for outdoor use, and operates in temperatures from -25 to 75°C. KwikLink connector designed for the flat cable eliminates the need to cut and strip the cable before connection.

Rockwell Automation/Allen-Bradley **Circle 412**

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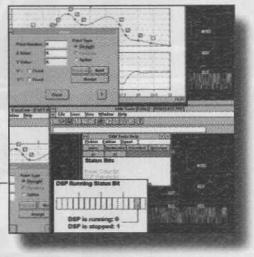
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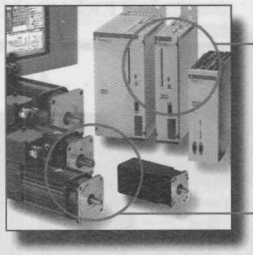
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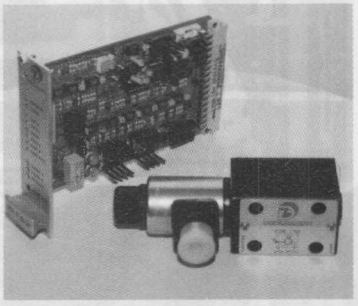
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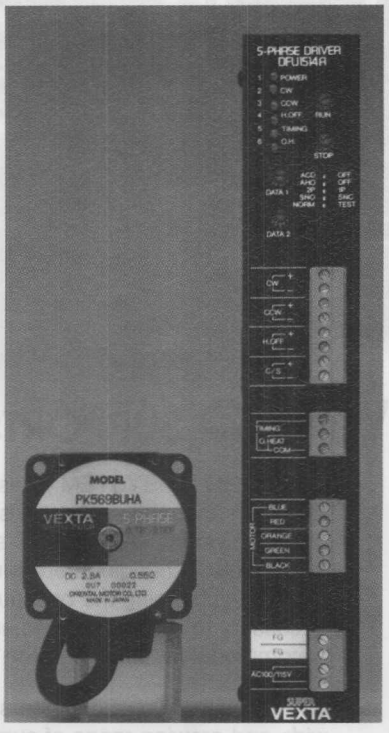
Proportional Control Valves



Twinsburg, O.—Available in pressure, flow, and directional control configurations, Duplomatic proportional valves will handle flows to 50 gpm at operating pressures to 5,000 psi. The CDE 3/50 model is a pressure control valve with a NFPA D03 mounting suitable for piloting two stage valves or controlling pressure in hydraulic circuits. Duplomatic is controlled by a 700 milliamp coil providing repeatability of ±2%.

Universal Hydraulics International Ltd. Circle 415

Step Motor and Drive



Torrance, Calif.—UFK Nanostep motor and drive package incorporates the latest 5-phase microstepping technology. Six 5-phase hybrid step motor models have been developed and matched to the UFK drive. Motors range from the UFK543AA which develops 18 oz-in constant torque over a speed range of 6 to 480 rpm to the UFK569AA, which generates 220 oz-in. of constant torque over a range of 6 to 72 rpm. UFK569AA still maintains 50 oz-in. of torque at 300 rpm. The compact Nanostep drive requires 115 V ac and delivers 1.4 A per phase. The drive has 16 user selectable resolutions, ranging from full step to 250 microsteps per cardinal step (125,000 steps/rev), accepts up to two different preset resolutions from an external input.

Oriental Motor U.S.A. Corp. **Circle 408**

Prewired PLC Cables

Irving, Tex.—The new Interfast product line from Entrelec is a family of prewired cables and connectors that simplfies interconnecting field wiring to PLCs. Individual wires are traditionally hand-connected, point by point from the PLC to the field terminal block or interface board. Using standard prewired and

(continued on p. 174)



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For information circle **125**

CONTROL ENGINEERING
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pretested cables and connectors, Interfast can increase wiring speed up to 20 times, cut costs, and reduce errors. Interfast supports PLC digital and analog signals from Siemens, Allen-Bradley, GE Fanuc, AEG, Modicon, Telemecanique, and Cegelec. The product line comes in three solutions, Interfast 1, 2, and 3, for different PLCs and applications, but for all three the usual field screw terminal is replaced by a connector interface board or terminal blocks that accept Entrelec's Omniconnect plugs. These allow the addition of LEDs, relays, optocouplers, test points, or special components. Interfast also fits virtually all systems applications, such as I/O voltages of 24, 48, 115, and 230 V, and output currents from 0.5 to 2 A and up to 5 A using relay or triac output cards.

Entrelec Inc. **Circle 472**

Industrial Process Robots

Elgin, Ill—Reis Robotics' new line of articulated-arm, six-axis robots feature payload capacities from 6 to 130 kg, and the ability to automate many industrial operations, such as material handling, machine tending, welding and cutting, gluing, coating, and spraying. Special aspects include ac drive technology with a digital, error-tolerant absolute measuring system to eliminate the effects of electromagnetic interference and guarantee precise motion control. Reis' robots are designed with the "Finite Element Method" to ensure a high rigidity-to-mass ratio, and they also feature improved joint seals for operating in harsh environments. The robot's controller is also coupled with a teach pendant that improves ease of programming and operation.

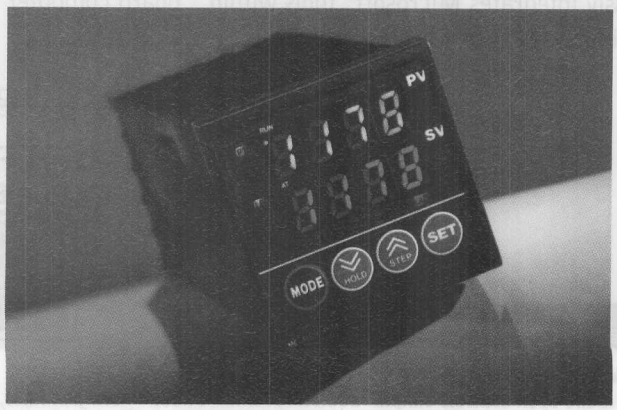
Reis Robotics **Circle 470**

(continued on p. 176)

Ramp/Soak Program Controller

South Bend, Ind.—REX-P24 is a 1/16-DIN ramp/soak program controller. It combines compact size for panel space reduction with features that previously have only been available in much larger controllers. REX-P24 offers two patterns that can be programmed to eight segments each, or linked to create a larger pattern of 16 segments. There are three operating modes: program temperature, timer-temperature, and fixed setpoint. Each mode can be changed to adapt to various process requirements.

Syscon-RKC **Circle 421**



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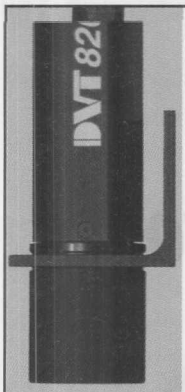
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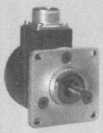
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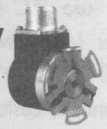
For information circle **127**

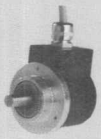
The Encoder Source

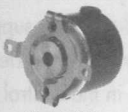
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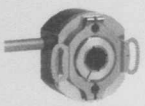

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Model 702
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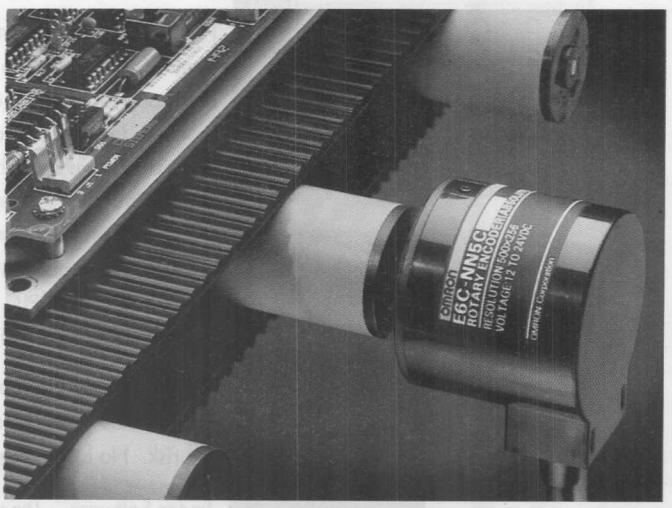
Rate/RPM/Frequency Input DPM

Tucson, Ariz.—Model 210 digital panel meter accepts input signals from magnetic pick-ups, photocells, encoders, proximity detectors, transmitters, and power lines. Its Frequency-Voltage technique converts these inputs to a 0-2 V dc for the 4.5 digit A/D. The F-V system allows frequency measurement and control without the need for specific gear ratios.

Otek Corp. **Circle 404**

Multiple Rotation Encoder

Schaumburg, Ill.—E6C-N is a multiple rotation encoder said to offer a number of time-saving, ease-of-use features for a variety of motion applications, including tripping detection of stepper motors, numeric controlled table and stacker crane



positioning, and timing control of conveyor lines and packaging machinery. The device retains the origin point so that it does not need to be reset at power up. A conventional reset function for multirotation data and a reset function for single rotation allow simple origin setting of the encoder mounting and saves steps required for the reset operation. E6C-N also remembers cumulative position as it is turned more than two rotations, while keeping track of both numbers of rotations and positioning. Device head size is 50-mm dia. by 45-mm high. It features a 12-24 V dc power supply and an IEC IP50 enclosure rating.

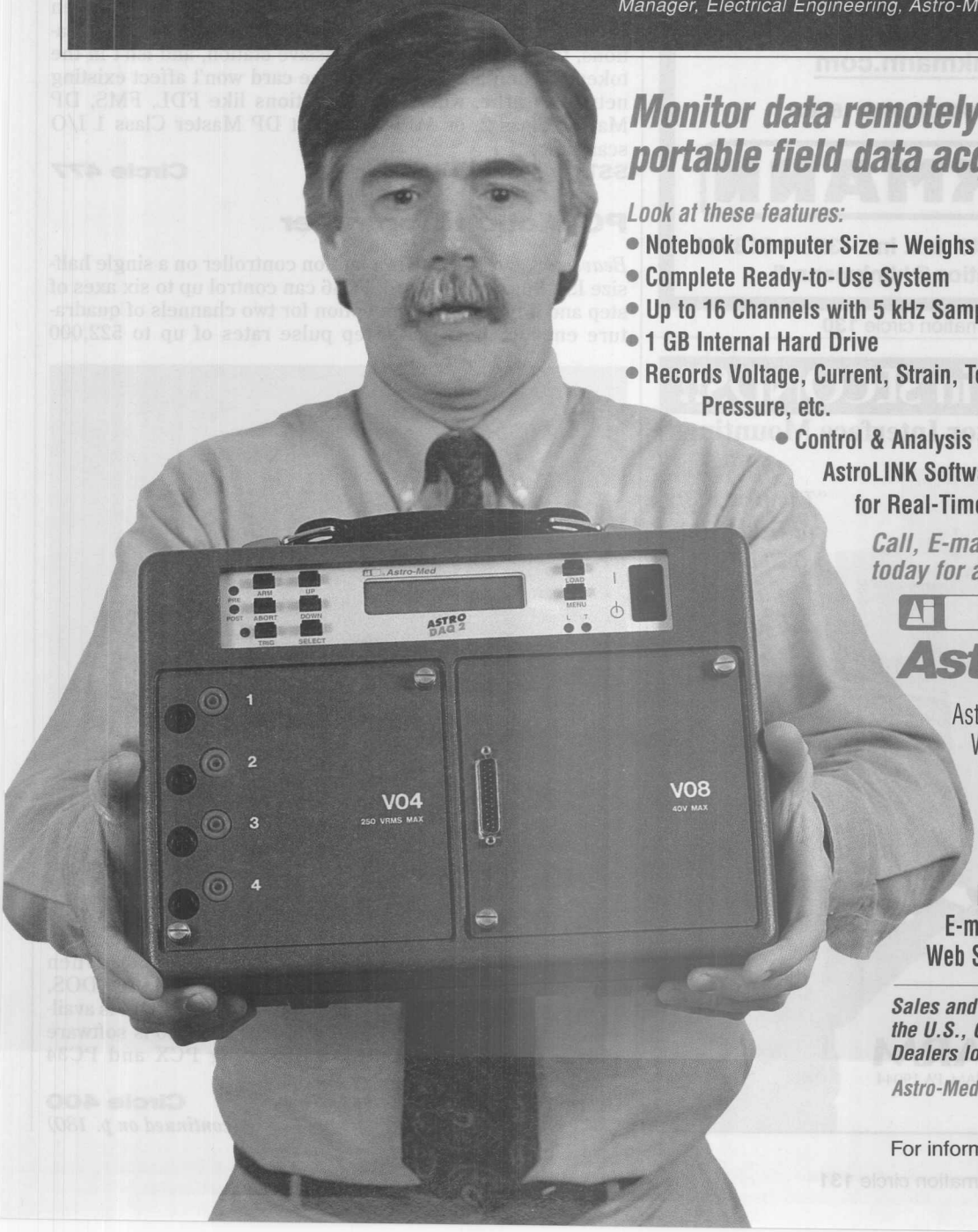
Omron Electronics Inc. **Circle 443**

(continued on p. 178)

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Manager, Electrical Engineering, Astro-Med, Inc.



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For information circle **131**

PRODUCTS & SOFTWARE

Multi-Slave Interface Card

Waterloo, Ontario, Canada—Newly released by SST, the 5136-PMBS multi-slave Profibus interface card in ISA format is reported to be the first card that can assume more than one DP slave station address. Its developers say the card is unique because it emulates one to 125 Profibus stations, and can monitor one to 125 real slave devices without affecting existing network traffic. Users aren't limited to 244 bytes in and out, several DP Class 1 Masters can communicate to one multi-slave card, and little set up and configuration is required of the user. Instead of using an ASIC, the 5136-PMBS card's network protocol is implemented within a field upgradable hardware component called an "fpga." Applications include OI/HMI and I/O simulation using SST's PICs simulation software. When the Profibus Multi-Slave Card is used for OI/HMI applications, the card connects as a passive station, and isn't in the token rotation list. As a result, the card won't affect existing network traffic, where active stations like FDL, FMS, DP Master Class 2, or MPI will affect DP Master Class 1 I/O scan times.

SST (formerly S-S Technologies) **Circle 477**

PC Motion Controller

Beaverton, Ore.—PC46 is a motion controller on a single half-size ISA bus circuit board. PC46 can control up to six axes of step and direction with an option for two channels of quadrature encoder feedback. Step pulse rates of up to 522,000



pulses per second can be produced, and encoder signals of up to 4 MHz are supported. Interrupt levels 2 through 15 are supported, as well as operation in a polled mode when interrupts are not desired. Software is available for DOS, Microsoft Windows 3.1, 95, and NT. Example software is available written in C/C[++], Basic, and Pascal. PC46 is software and hardware compatible with existing PCX and PC34 controllers.

Oregon Micro Systems Inc. **Circle 400**

(continued on p. 180)

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For information circle 133

Color mark sensor



Minneapolis, Minn.—The R55 color mark sensor has a solid-state emitter and receiver that will detect all colors found in today's print jobs. R55 has a response time of 50 μseconds and includes a built-in 50 ms off-delay timer and one-shot logic to slow down inputs to plcs. A moving bar display on the sensor indicates contrast level between the color mark, the background, and the sensor switch point. The R55 also has an analog output. It meets IEC IP67 and NEMA 6 enclosure standards, and contains electrical protection from high voltage transients and reverse polarity. Connections are made with either an attached, potted-in cable or a 5-pin, euro-style pigtail quick-disconnect.

Banner Engineering Corp.

Circle 424

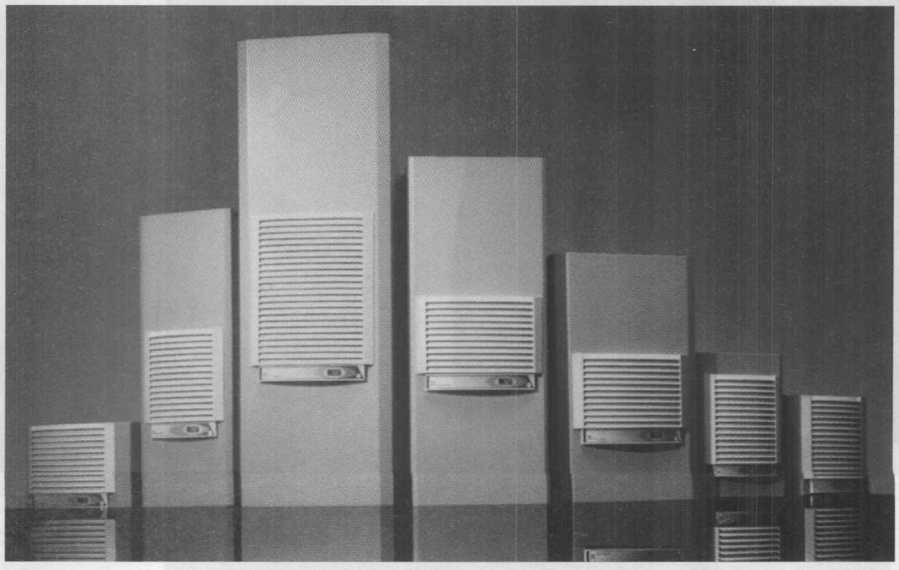
Enclosure Air Conditioners

Champlin, Minn.—Genesis air conditioner line has a beveled front cover, a high impact polycarbonate ABS grille, few visible fasteners, and no visible mounting rails. Standard features include a thermostat with electronic digital display and high temperature alarm, and a built-in condensate management system. For mounting, a full size template and EZ Mount flanges are provided. The seven models range from 1,000 to 12,000 BTU/hr. All have UL and Canadian UL recognition and CE approval. All have NEMA 12 enclosures.

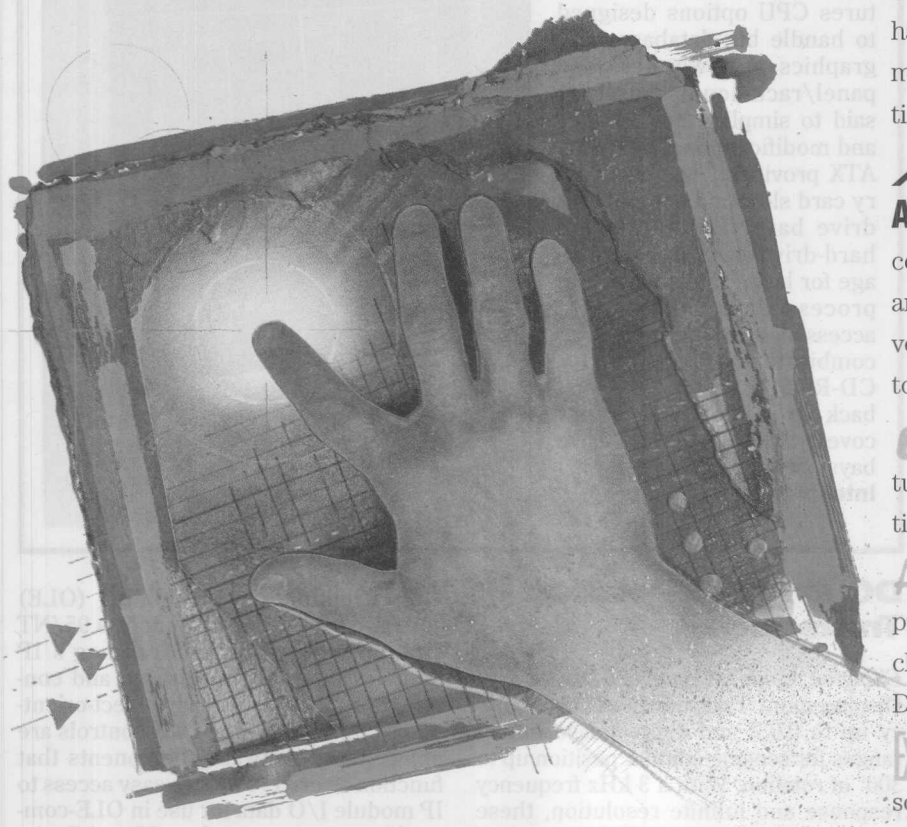
ZERO McLean Midwest

Circle 405

(continued on p. 182)



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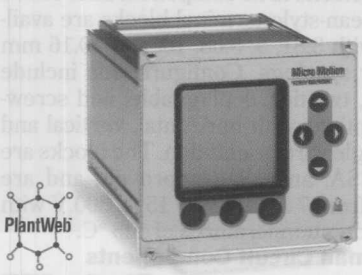
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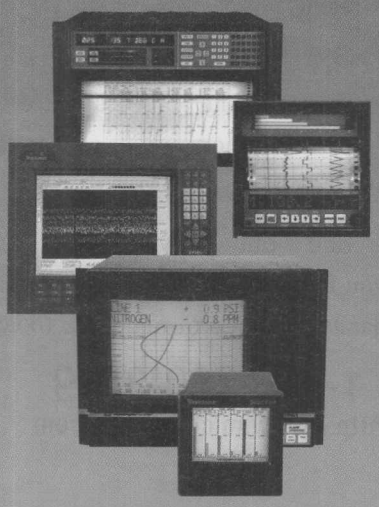
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For information circle 135

PRODUCTS & SOFTWARE

20-in. Workstation

Duluth, Ga.—The 20-in. Venus ATX Workstation features CPU options designed to handle big databases and graphics. A newly designed panel/rackmount chassis is said to simplify maintenance and modifications. The Venus ATX provides seven accessory card slots and a total of six drive bays. Three internal hard-drive bays house storage for large applications and process data. Three front access bays let designers load combinations of floppy drives, CD-ROM drives, and tape back up units. A sealed door covers the front access drive bays, switches, and ports.

Intecolor Corp.

Circle 410



DC Angular Position Transducer

Ellington, Conn.—Model 605 DC Angular Displacement Transducer offers accuracy up to 0.03° and eight measurement ranges for sensing angular position up to 300° of rotation. With a 3 kHz frequency response and infinite resolution, these transducers from Trans-Tek are suited for use as servo feedback sensors or in applications requiring dependable absolute position sensing. They are also a good alternative to absolute encoders. Other features include: standardized dc outputs including 4-20 mA, rugged housing, two different mounting methods, and connector termination. Accuracy is greater than 0.25% FS including nonliterary, hysteresis, repeatability, as well as unit to unit variation.

Trans-Tek Inc. **Circle 471**

PCI Carrier Board

Wixom, Mich.—Acromag's new APC8620 PCI board interfaces up to five IndustryPack-type ANSI/VITA-4 modules to a PC. By installing analog, digital, and serial I/O modules on the APC8620 carrier card in any combination, users can efficiently develop custom I/O boards with high channel density. Users can also choose from more than 40 Acromag IP modules or hundreds available from third parties. Object linking and embedding (OLE) software for Microsoft Windows 95/NT simplifies integrating Acromag's IP modules into data acquisition and control applications with easy object-oriented programming. The OLE controls are object-based software components that function as drivers to give easy access to IP module I/O data for use in OLE-compatible programs, such as Visual Basic, Visual C++, Borland Delphi, and many human-machine interface software products. These OLE controls handle many common functions, such as register reads, writes, and interrupts to eliminate many programming chores.

Acromag **Circle 473**

Expanded Terminal Block Line

Chicago—Bussman Circuit Components has added new Magnum Euro-Mag terminal blocks to its component line. These European-style terminal blocks are available with 3.81, 5, 5.08, 10, and 10.16 mm center spacings. Configurations include single, two-tier, depluggable, and screwless options with horizontal, vertical and 45° angle wire orientation. The blocks are UL, CSA, and VDE approved, and are rated from 7 A, 300 V to 15 A, 300 V with operating temperatures of 105 °C.

Bussman Circuit Components

Circle 475

(continued on p. 184)

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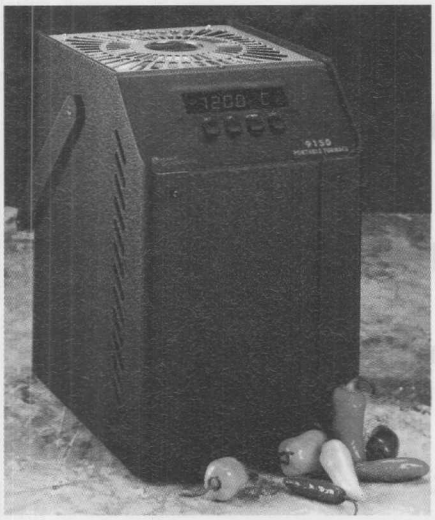
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D-1064

Thermocouple Calibration Furnace

American Fork, Ut.—The 9150 Portable Thermocouple Calibration Furnace calibrates thermocouples to 1,200 °C (2,200 °F) with an accuracy of ±4 °C (±7.2 °F), stability of ±0.5 °C (±0.9 °F), and cost less than $5,000. The 9150 weighs less than 30 lb. Removable well sleeves permit checking most sizes of probes up to ½-in. dia. The 9150 comes with a report of calibration traceable to NIST. Microsoft Windows-based software controls the furnace with communications via RS-232.

Hart Scientific Inc. **Circle 418**



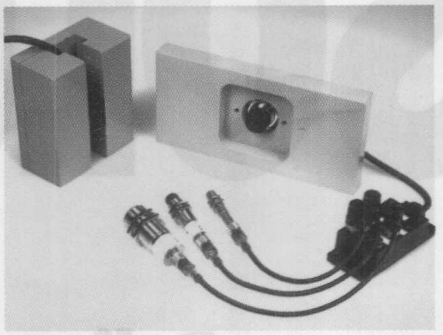
Power Conditioner

Troy, Mich.—Power Purifier, a new industrial power conditioner from the Controlled Power Co., is a line-interactive, double magnetic conversion system, which allows it to solve more than 99.95% of all power problems and protect sensitive equipment from electrical anomalies. Offered with a 20-year warranty, the Power Purifier also has a mini-backup capability that allows it to outlast power outages of 16 msec. This helps it outperform standby uninterruptible power supplies during momentary power outages. Power Purifier's variable range regulation features provides [+/-]2.5% output voltage regulation during input variations as severe as -50% to +200%. It also has a "K factor" rating of 30+ and provides -26 dB attenuation of odd current harmonics generated by today's switching power supplies. This lessens harmonic current reflected into a building's electrical system.

Controlled Power Co. **Circle 474**

Wireless Sensor

Florence, Ky.—T-Slot Power Remote Tooling Sensor System eliminates the "hard" connection to sensors embedded in tooling, dies, and fixtures on stamping and forming presses. The system delivers sensor power and transmits signals inductively across an air gap, supporting up to four tool-mounted sensors without a



hardwired connection to the control or power source. Almost any 12 V dc sensor or switch can be used with the system including proximity, air-pressure, photoelectric, magnetic, capacitive, or ultrasonic. The system has two parts that must align to transmit signals and power across a gap up to 6-mm wide: a receiver mounted on the press and a transmitter mounted on the tooling. Highly resistant to shock and vibration, the T-Slot Power Remote system is sealed to IP67.

Balluff **Circle 423**

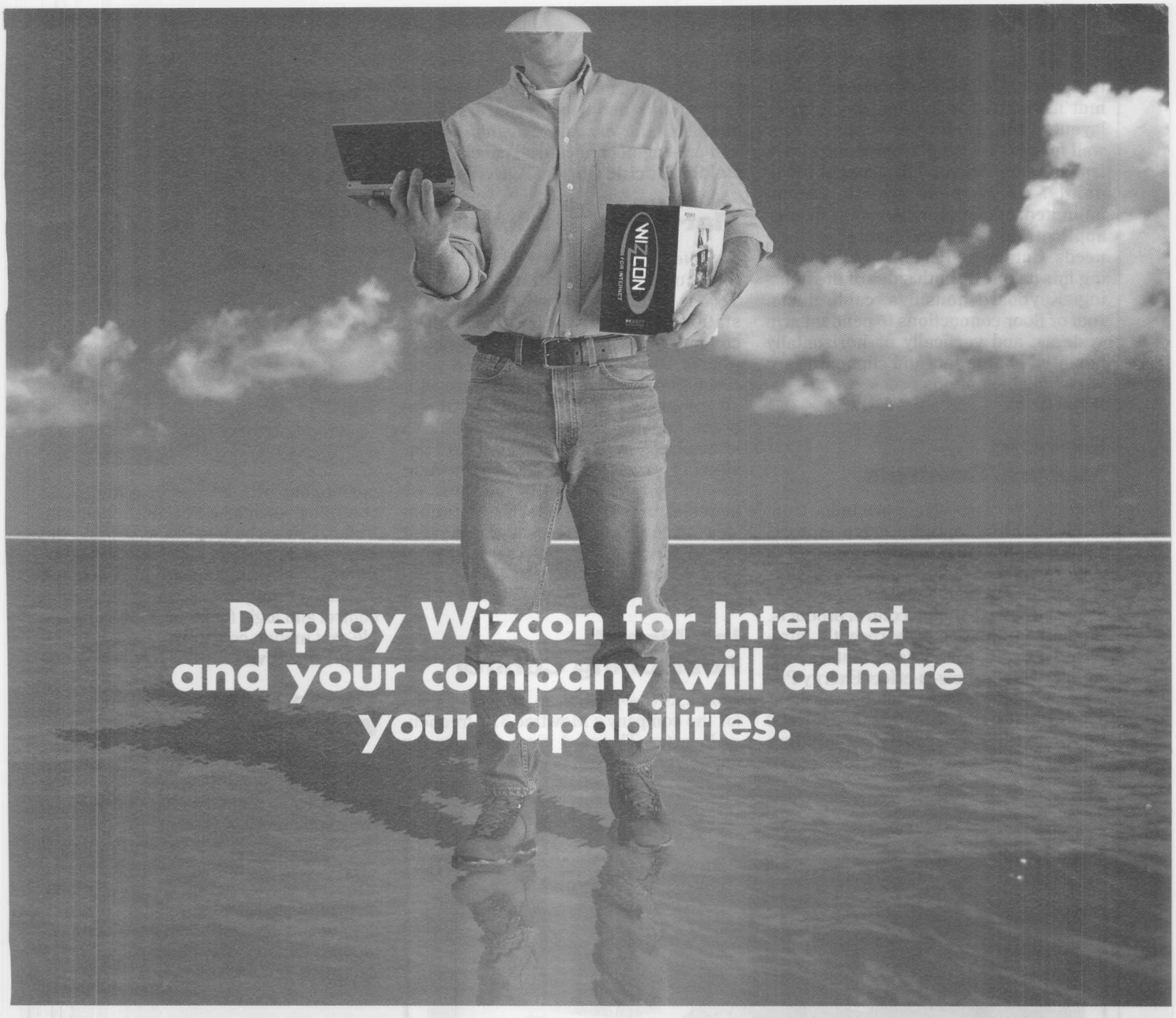
Enclosure Has Flat-Panel Display Options

Springfield, O.—To give compact hardware the specialized packaging it needs, Rittal has created its new Command Panel VIP 6000 Series, a modular, compact enclosure with more than 60 configuration options. The series features a con-

(continued on p. 186)

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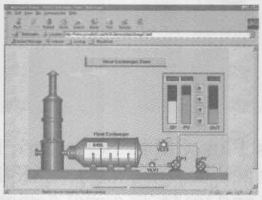
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For information circle **138**

PRODUCTS AND SOFTWARE

tinuous profile of screw channels in a 25-mm matrix for individualized interior layout, a hinged door or screw-on rear wall for rear housing access, and clip-in fasteners for individually adapted fixing points. All of these provide almost unlimited options for flat-panel display applications. To meet users' cooling needs, Command Panel also offers cooling fins on one or both sides of the housing. Keyboard housings, cable ducts, roof or floor connections to pendant arm systems, and vertically or horizontally mounted handle sets and clipboards are also available options.

Rittal Corp. **Circle 483**

Electric Motors/Controls

Fort Smith, Ark.—New products from Baldor include spindle drive motors, square flange pump motors, encoderless vector controls, hollow-shaft gear reducers, large 5800 frame motors, and a new line of advanced motion control products. In addition, the company recently introduced its new Standard-E motors that comply with the now-in-effect Energy Policy Act. Baldor is also exhibiting its energy efficient ac and dc motors through 800 hp; adjustible-speed drives including inverter and vector controls; servo motors with controls and accessories; gear motors and speed reducers; solid-state soft starters and dynamic brakes; and pre-engineered control panels.

Baldor Electric Co. **Circle 476**

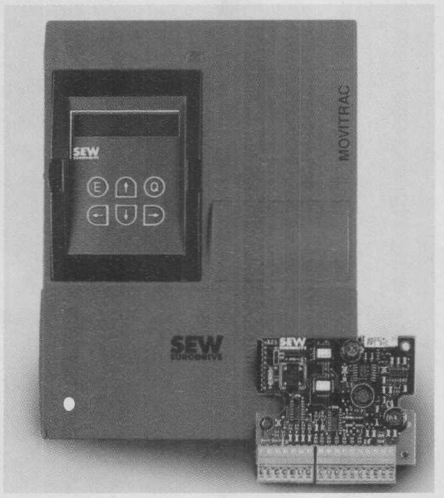
Flat-Panel Workstation

Suwanee, Ga.—The new Profile Series of industrial workstations from Pro-Tech is highlighted by a flat-panel workstation that interfaces with standard computer systems. It features an Active Matrix Display with 1,024 x 768 pixel resolution, standard VGA interface with an integrated touchscreen and membrane keyboard/mouse. Profile Series is available in 13.8, 15.1, and 18.1 in. viewing sizes. An optional Flex-Arm assembly allows wall, column, or pedestal mounts to provide optimum viewing angles. The workstation is rated for NEMA 4/4X environments, and is suitable for ambients up to 45 °C.

Pro-Tech **Circle 479**

Intelligent Positioning Control

Lyman, S.C.—IPOS is an expansion card for the company's Movitrac 31C frequency inverter. The card gives the inverter the ability to control point-to-point motor



positioning without use of a high-level controller, such as a PLC or motion controller. Using a built-in PLC-type logic, the Movitrac 31C offers capabilities such as timers, math functions, and timer and activation of outputs, as well as the motion control and logic functions found in a single-axis motion controller.

Sew-Eurodrive **Circle 429**

Clean Room 100% Web Inspection

Frederick, Md.—TruProfile Gage System can accommodate 36-in. and 72-in. wide webs in clean room operations. The Gage constantly profiles 100% measurement of the complete web. A 36-in. TruProfile will make 1,296,000 measurements in 15 min., allowing use of actual measurements, instead of statistical sampling. Total web area quality measurement and documentation is continuously obtained.

Adaptive Technologies Inc. **Circle 426**

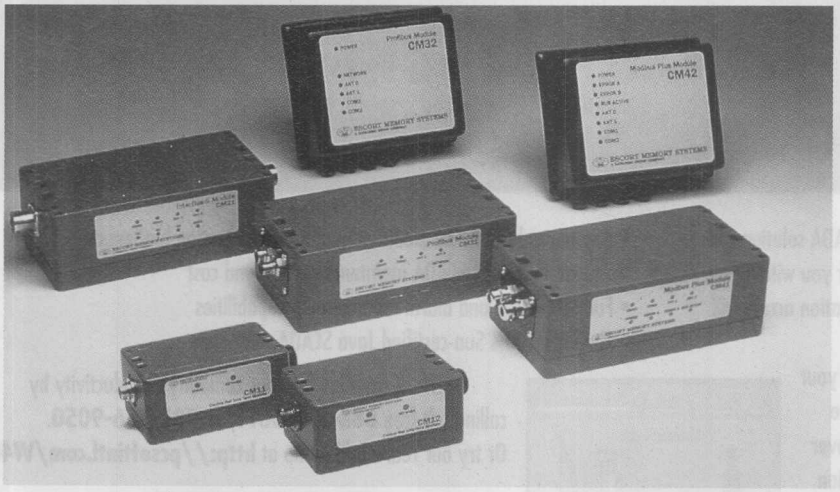
Surface Mount Package for Pressure Sensors

Milpitas, Calif.—Series SX-SMT and SCC-SMT are pressure sensors in a surface-mount package configuration, based on a reliable integrated circuit sensing element. Both series allow design engineers the flexibility of using a low-cost surface-mount device. Present applications include altimeters, barometers, and tire pressure gages. These devices are designed for measuring absolute and gage pressures for five ranges from 0-1 psi, through 0-300 psi.

SenSym Inc. **Circle 413**

(continued on p. 188)

Field-Mountable Bus Modules



Scotts Valley, Calif.—Profibus CM30 and Modbus Plus CM40 Series are field-mountable, general-purpose, programmable interface bus modules. CM30 and CM40 modules are placed between their networks and up to 32 serial devices on a MUX32 line. They bring Profibus and Modbus Plus capabilities to bar code readers, RFID controllers, bar code verfiers, sensors, and switches.

Escort Memory Systems **Circle 440**



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New Plug-in "Midi-Maxi" Pneumatic Valve Manifolds Eliminate Hidden Wiring!

Plug-in connections between valves and sub-bases and from sub-base to sub-base eliminate the wiring... inside and out!

- New Plug-in Valves
- New Flow Controls
- New Pressure Regulators
- New Plug-in Low-cost Multi-pin Connector
- New Plug-in Analog and Digital I/O
- New Plug-in Actuator/ Sensor/ Interface Module
- Plug-in Electric I/O
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Totally Modular Flexibility!

- Compatible with DeviceNet, and Most Other Fieldbus Protocols*
- Mix Two Valve Sizes on One Manifold
- Metric or inch ports
- Easily expanded
- Up to 26 coils, 128 I/O per manifold

Plus **"Smart" Valve Manifolds** with embedded PLC.

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Save up to 80% on Installation,Time, Labor and Costs!

- Factory preassembled to your custom configuration
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Call or fax us for more information on the new Midi-Maxi Manifolds.

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For Low-cost Automation

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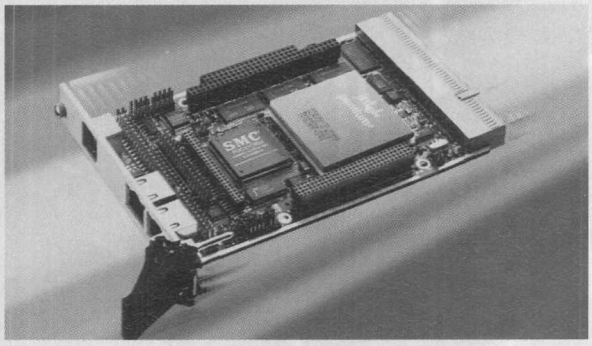
For information circle **139**

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Pentium on CompactPCI Bus

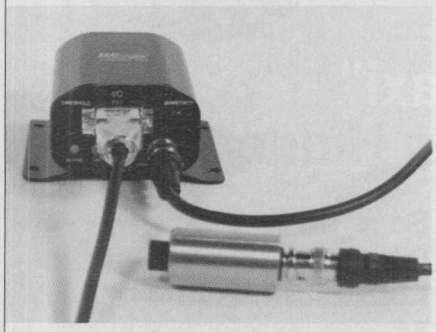


Amaro (UD), Italy—CPU-ETH-0996 is a Pentium processor board on a 3U Eurocard format compatible with the CompactPCI standard. It is equipped with a 100, 133 or 166 MHz Pentium CPU, 32 or 64 Mbytes of soldered EDO DRAM, 256 KB synchronous L2 cache, two enhanced IDE contollers, floppy disk interface, RS232 or RS422/485, LPT1, and keyboard interfaces. Watchdog, RTC, EEPROM for setup backup and 1MB SSD with built-in "ROM_DOS" and software utilities are also included. Up to seven peripheral functions can be added through the CompactPCI bus connector. Using a standard BIOS, the ETH-0996 can run any operating system available for PCs such as Microsoft Windows 3.11, 95 and NT; OS/2; UNIX; QNX; PSOS; and Pharlap. The ETH-0996 is said to be ideally suited for use in real-time data acquisitiion and control, industrial automation, and high speed data communication.

Eurotech S.r.l. **Circle 414**

Ultrasonic Condition Alert

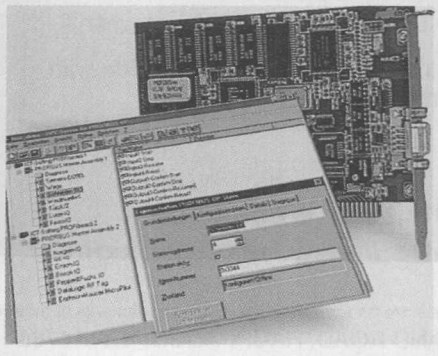
Elmsford, N.Y.—Ultrasonic Condition Alert (UCA) continuously monitors operating equipment accurately pinpointing leakage, blockage, and mechanical wear. The small on-line sensors may be permanently fixed to any surface. The sensors note changes in amplitude produced by operating equipment. Alarm levels may be adjusted to warn of an increase or drop in amplitude along a specified voltage range to indicate flow/no flow in pipes or valves and wear in bearings. The UCA uses standard 0-10 V dc or 4-20 mA outputs to trigger an alarm or send data to a PC or other device. The UCA also demodulates ultrasonic signals into the audible range to emit a localized output, which provides instant feedback to an operator or technician.



UE System Inc. **Circle 411**

OPC Server for Profibus

North Andover, Mass.—Integrated Control Technology has made available new OPC server software for the company's Profibus network interface boards on Microsoft Windows NT platforms. The new server complies with the OPC standard interface and allows users to quickly and easily access Profibus network devices. The user interface is designed with the look and feel of Windows Explorer, which is said to make learning and usage simpler.



Integrated Control Technology **Circle 402**

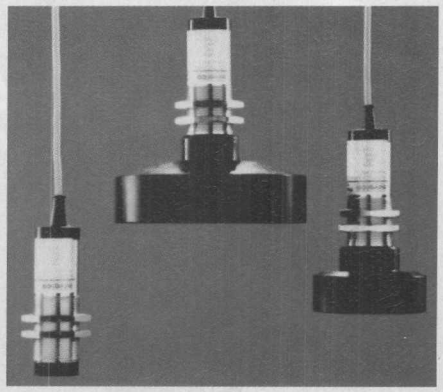
Small Enclosure Air Conditioners

Greensburg, Pa.—Ice Qube's thinner versions of its top mount and wall mount air conditioners are designed to complement increasing use of smaller electrical, electronic, and computer enclosures in manufacturing. The company's product line ranges from 1,500 to 12,000 BTU/hr, and all its systems feature 16 gauge welded steel, dent-resistant cabinet construction, efficient rotary compressors, maintenance free blowers, cleanable air filters, built-in condensate evaporation packages, and easy-to-use controllers, which provide programmable temperature setpoints, visual and audible temperature alarms, security access codes, temperature displays in °F and °C, and operating status indicators for cooling, heating and alarm conditions.

Ice Qube Inc. **Circle 478**

Ultrasonic Proximity Sensors

Newton, Pa.—SonicLaser ultrasonic proximity sensors come in 18 models and feature a narrow, concentrated beam angle



2.5° off-center axis. This narrow beam angle is said to render the sensor insensitive to echo interference from surrounding objects. Measuring ranges vary from 3.28 to 26.25 ft., depending on the model. Accuracy is rated from 0.08 to 0.2-in. The sensors operate in temperatures ranging from –20 to +140 °F.

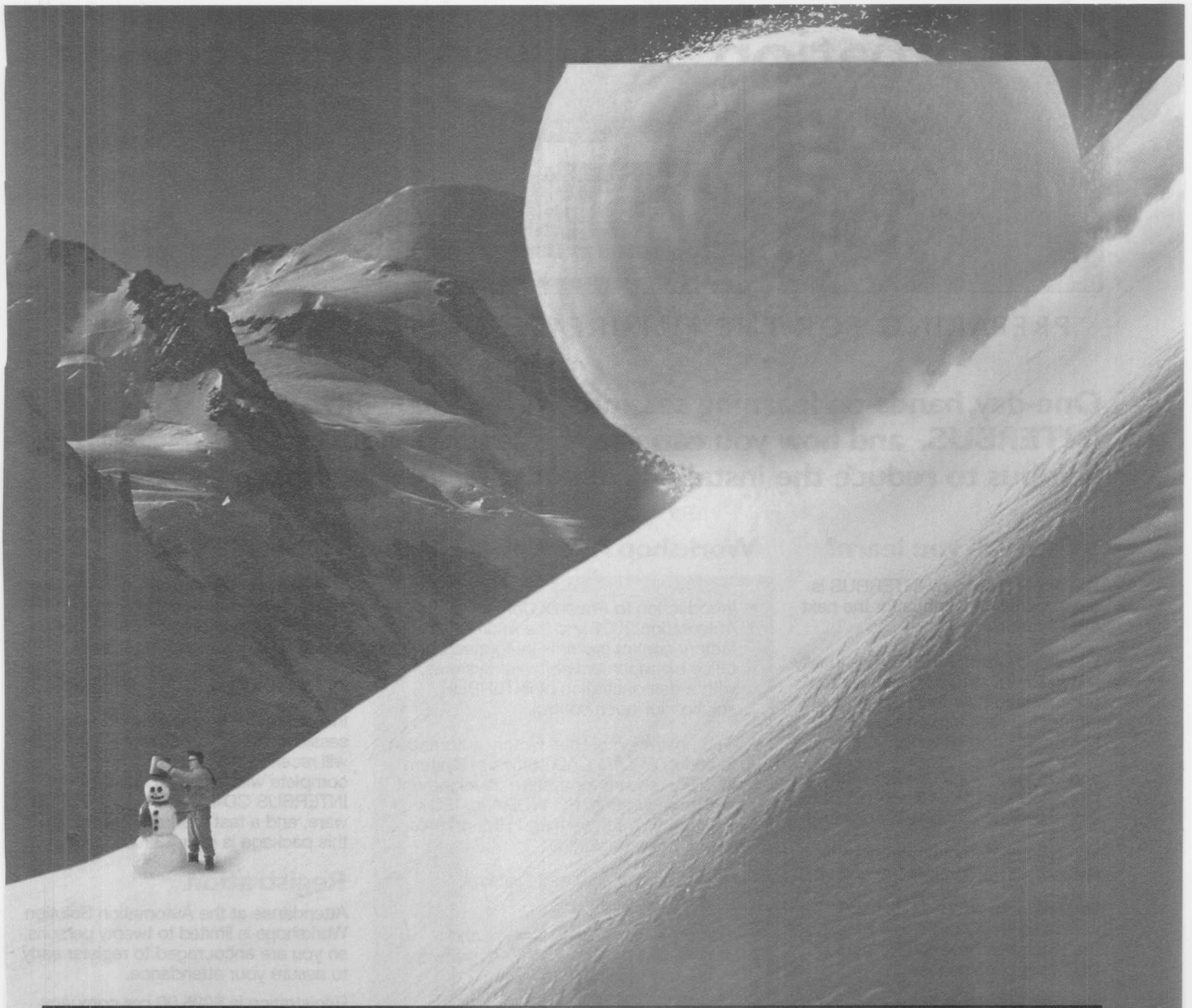
HiTech Technologies Inc.

Circle 428

Built-to-Order DeviceNet Stations

Wauwatosa, Wis.—Plug-and-play DeviceNet operator stations from Panel-

(continued on p. 191)



CUTLER-HAMMER SENSORS.
BECAUSE YOU'VE GOT ENOUGH THINGS TO WORRY ABOUT.

Choose the wrong sensor and problems are sure to follow. Not with a solution from today's Cutler-Hammer. We deliver sensing expertise and innovative products — from the world's smallest DeviceNet photoelectric sensor to powerful inductive proximity sensors with more than three times the range of standard proxes. Whether it's a combination of different sensing technologies, a modified product or simply a standard product delivered when you need it, you get the best, most cost-effective sensing solution. It's one less thing to worry about. Call 1-800-525-2000 for your free Sensing Solutions Guide, or visit our web site at www.cutlerhammer.eaton.com.

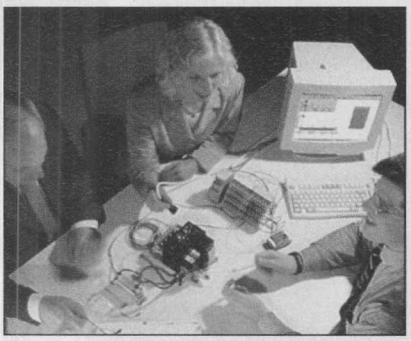


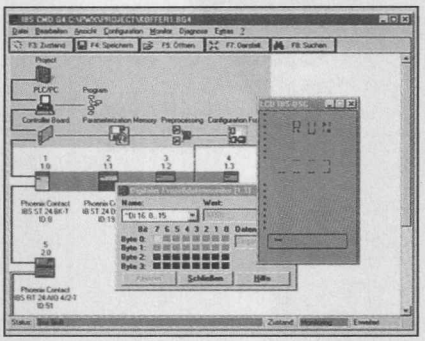
Cutler-Hammer

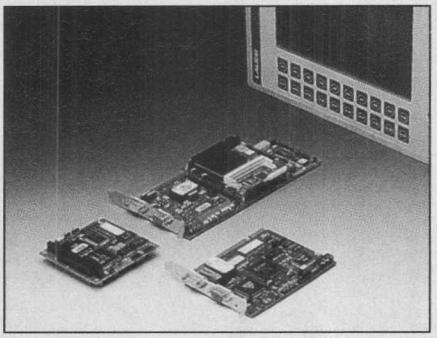
EATON

For information circle **140**

Automation Solution Workshops







PREPARING FOR THE FUTURE OF FACTORY AUTOMATION.

One-day, hands-on learning sessions with a focus on INTERBUS, and how you can use this leading industrial fieldbus to reduce the installed cost of your I/O system.

INTERBUS

What will you learn?

You will find out why INTERBUS is the automation fieldbus for the next millennium.

You will see how INTERBUS is ideally suited for the future "Open Control" concept and how to integrate your factory I/O data into corporate Microsoft™ applications.

You will learn about the simplicity and effectiveness of the INTERBUS architecture protocol and software.

You will see demonstrations of diagnostics, programming, and HMI.

You will learn about INTERBUS versus other I/O protocols as well as the difference between PC versus PLC control solutions.

You will participate in one-on-one sessions with factory support engineers with emphasis on your specific application.

You will understand how other Phoenix Contact products also help enhance your automation solution.

You will build a complete INTERBUS system and experience IEC 1131 programming; system troubleshooting and diagnostics; and remote I/O for your graphics control packages and HMI.

Workshop Agenda

- Introduction to Phoenix Contact Automation 2001 and the future of factory control systems integrated into office management software systems, with a demonstration of INTERBUS solution for open control.
- Demonstration of total factory automation featuring EPLAN CAD software. System WORX software for system development and configuration. PC WORX for IEC 1131 control software and HMI graphic visualization packages.
- Use of Architecture and Protocol, Learning Software.
- Practice System configuration and diagnostics via System WORX software.
- Introduction to System programming with IEC 1131 PC WORX software.
- Review of HMI graphic visualization interfaces.
- Explore 3rd party software packages, PLC controllers, HMI and front end control.
- Compare competitive protocols, architecture, diagnostics versus total installed costs demonstrating an actual running system.
- Questions & Answers

LUNCH

Optional Sessions

The afternoon will be devoted to one-on-one sessions with the emphasis on specific applications. This is an option and you are invited to participate.

What else is included?

In addition to the one-day learning session, each attendee of the Workshop will receive an INTERBUS Test Kit, complete with a fieldbus controller, INTERBUS CD-ROM, PC WORX software, and a test module. The value of this package is over $3500.

Registration

Attendance at the Automation Solution Workshops is limited to twenty persons, so you are encouraged to register early to assure your attendance.

Registration is $995.00 per company with a limit of two persons per company per registration. Workshops are available to INTERBUS Club members at a reduced price.

For more information about the Workshops or to register, call the INTERBUS Systems Group at **1-800-586-5525** or the INTERBUS Club at 1-888-281-2871. Or fax Phoenix Contact at: 717-944-1625

PHOENIX CONTACT

INNOVATION IN INTERFACE

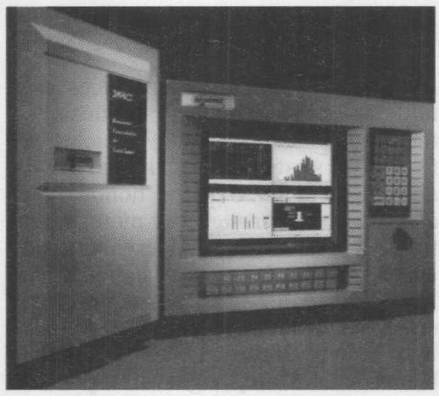
Brought to you in conjunction with your authorized Automation Products Distributor.

For information circle **170**

Works LLC, a new subsidiary of Real Time Automation, allow users to: choose among Allen-Bradley, Cutler-Hammer, General Electric, or Square D oil tight operators in either 22 or 30.5 mm sizes; buy stations for two to six operators with metallic and nonmetallic enclosures; and arrange operators without creating CAD drawings. The stations also offer pilot lights, illuminated or nonilluminated pushbuttons; selector switches; and two-, three-, and four-position and hard-wired E-stop buttons. PanelWorks LLC also tests and configures each node for individual applications, including the baud rate, MAC-ID, and other attributes.
PanelWorks LLC, a subsidiary of Real Time Automation **Circle 480**

Measurement, Analysis, and Control System

Spring House, Pa.—MPACS (measurement, process analysis, and control system) advances the technology of dimensional measurement systems by blending advanced control software, standardized



hardware, and open system connectivity. Modular in design, MPACS uses any PC (commercial, industrial, customer standard, etc.) and Dynascan 4000 intelligent remote I/O system. The split-architecture system increases overall performance and permits third-party applications to be run on the PC without degrading measurement performance, regardless of software loaded on the PC.
Moore Measurement Systems Circle 433

Low-cost Annunciator

Natick, Mass.—The PD128 PLC annunciator displays up to eight messages at once, features a built-in horn, and is powered directly from the PLC. The red, yellow, and green LEDs are field interchangable, and custom message labels are available at no extra cost. Housed in a convenient ⅛ DIN panel-mount NEMA 4 case, the PD128 requires no programming. Operation starts after connecting a digital output from the PLC to the appropriate input on the PD128. Connections are made to removable screw terminals.
Precision Digital Corp. Circle 409

SBC Pentium Desktop

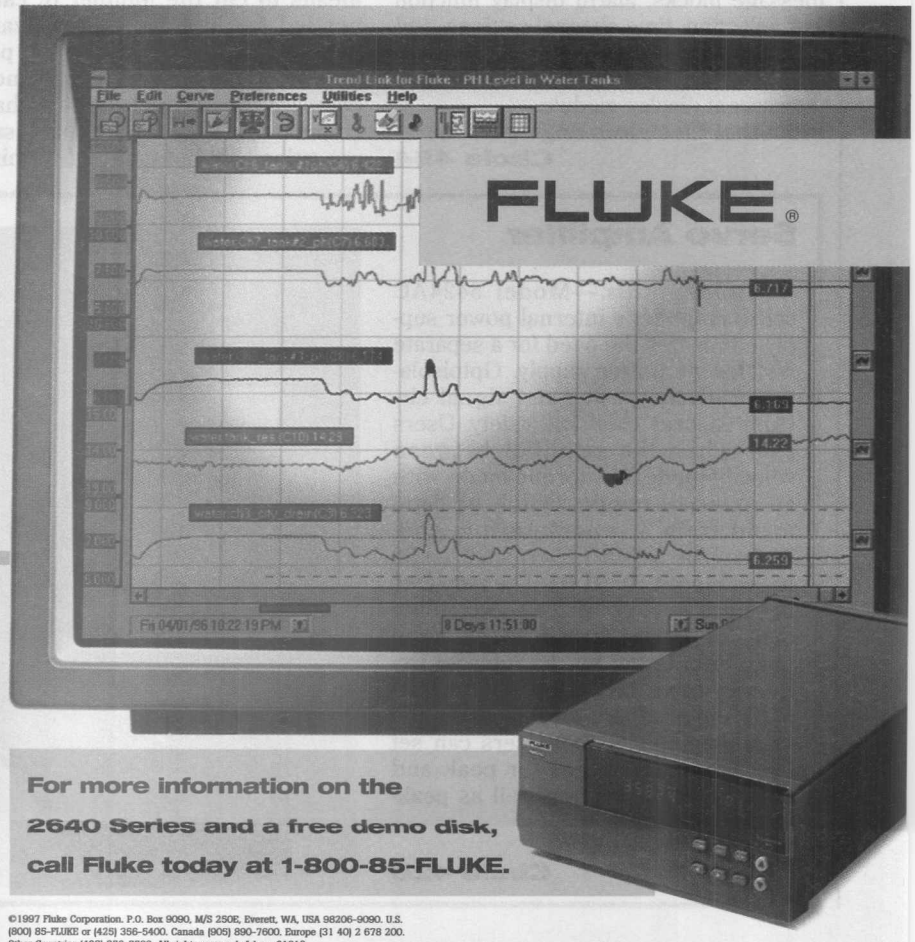
Greenville, S.C.—With all the functionality of the best MMX machines, the SBC-MaX from Computer Dynamics is a small form factor, single-board computer that is finding its way into many nondesktop applications, such as machine control, OEM products, and others requiring densely packed features. SBC-MaX includes an MMX Pentium CPU to 200

(continued on p. 192)

Your chart recorder is history.

The 2640 Series of data acquisition tools make strip chart recorders obsolete.

Fluke's 2640 Series, together with our intuitive trending software for Microsoft Windows® is an unbeatable team. The unit itself allows you to distribute data via local area networks. Plus its trending and analysis software can be run on multiple PCs to examine data from multiple locations. So gathering data from remote sites is a breeze. Its modular 20-channel, building block design allows for expansion up to 400 channels. Pick up a 2640 Series today. Let's face it, it's the chart recorder of the future.



For more information on the 2640 Series and a free demo disk, call Fluke today at 1-800-85-FLUKE.

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For information circle **141**

MHz, an advanced C&T 65555 video controller, 100BaseT Ethernet capability, 16-bit Sound Blaster audio, and two Universal Serial Bus ports. It also offers 128 M synchronous DRAM, and a 512 K level 2 cache. A hard disk drive can be mounted directly onto the board, and its two-channel IDE hard disk interface can support up to four IDE drives. The floppy disk controller supports two 1.44 or 2.88 M floppy drives.

Computer Dynamics **Circle 481**

PLC-Compatible Smart Terminal

Van Nuys, Calif.—The new VIP-Plus Series of smart terminals has expanded I/O capability, including built-in software drivers for many PLC manufacturers, which makes interfacing with user host systems easier. Developed by Industrial Electronic Engineers, VIP-Plus allows I/O port configuration for PLC "ladder program" passthrough without any disconnect from the terminal. Terminal configuration is done with a PC-based software program that sets up for PLC type, message blocks, alarm display function key selection, time channel settings, and LED indicator modules. Includes a four-line, 20 character, high visibility, vacuum fluorescent display module.

Industrial Electronic Engineers Inc. **Circle 484**

Hollow-Shaft Stepper

Dover, N.H.—Eastern Air Devices' new hollow-shaft stepping motor is designed to provide flexible packaging solutions for tight system integration. Available up to ⅝ in. OD, the hollow shaft allows access through the motor's central axis, which greatly increases packaging options for unique applications. The NEMA size 23 single-stack dc stepping motor measures 2.25 in. dia. by 2 in. long. Bidirectional, the motor is based on a 1.8° step angle with a position accuracy of [+/-]3% noncumulative. Peak torque is 50 oz-in. A full spectrum of windings is available to match all types of unipolar and bipolar drives. The motor is also CE approved to ensure electromagnetic compatibility.

Eastern Air Devices Inc. **Circle 482**

High Density IS Modules

Durham, U.K.—Series HiD 2000 provides control system builders with the means to cut the number of cabinets needed for interfacing to hazardous areas. Four channels may be packed into an 18-mm wide plug-in module, compared to the one or two channels common today. Further space savings are gained by the range of termination boards for mounting modules which incorporate loop-disconnect terminals on one side and a cross-wiring area on the other. These features eliminate the need for separate marshalling cabinets to house physical-to-logical I/O channel wiring, and knife-edge terminals for isolation and test.

Elcon Intrinsic Safety Ltd. **Circle 442**

Pentium CPU on CompactPCI

Amaro (UD), Italy—ETH-0996 is a CompactPCI-PC/104 single board computer with Pentium processor. It does not require a CompactPCI bus backplane to operate; it can operate alone in many applications because of on-board integration of the most commonly needed peripheral devices, including solid-state disk, floppy disk interface, keyboard and mouse controller, serial I/O, eight digital I/O ports, printer interface, speaker interface, interrupt controllers, counters/timers, watchdog timer, and real time clock.

Eurotech S.r.l. **Circle 448**

Single-Function Process Calibrators

Eindhoven, The Netherlands—The 710 Series offers five low-cost, handheld, single-function calibrators: the 712/RTD, 713/30G and 713/100G pressure, the 714/thermocouple, and the 715 Volt/mA calibrators. Each is a complete, cost-effective solution for calibrating a specific type of process control instrumentation. All have pushbutton interfaces. With dust- and splash-resistant case and EMI shielding, they can be carried in a technician's tool belt and used in the field.

Fluke Europe BV **Circle 432**

4X Pushbutton Enclosure

Anoka, Minn.—QLine polycarbonate Type 4X pushbutton enclosures feature a contoured body with flush, cross-point cover screws, which provide an attractive contemporary appearance. De-signed for 30.5 or 22.5 mm pushbuttons, configurations are available from one to six holes. QLine pushbutton enclosures are corrosion-resistant and meet UL Type 4, NEMA/EEMAC Type 4 and CSA Type 4.

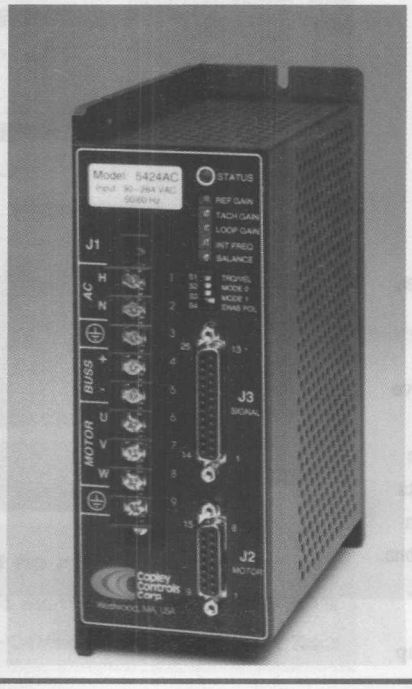
Hoffman **Circle 406**

(continued on p. 194)

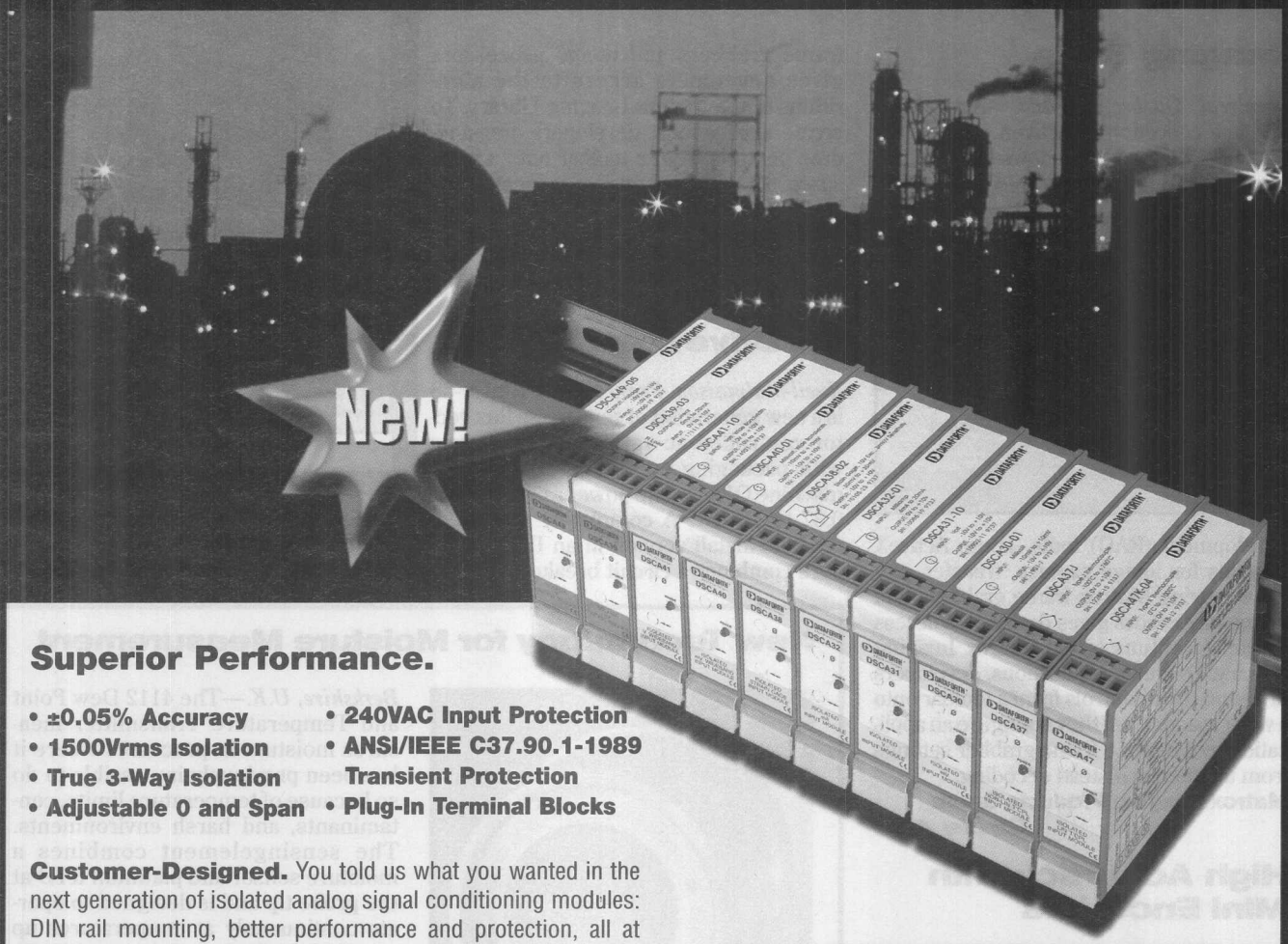
Servo Amplifier

Westwood, Mass.—Model 5424AC servo amplifier's internal power supply eliminates the need for a separate isolated dc power supply. Optoisolation between power and signal circuits ensures electrical safety. Users can switch the amplifier between velocity-mode and torque-mode with an external toggle switch or command from a programmable controller. The 5424AC operates from 90 to 264 V ac at 50/60 Hz. The amplifier develops ±20 A peak (±10 A continuous) for driving brushless dc servo motors up to 2.5 hp. An internal frequency-to-voltage converter eliminates the need for motor tachometers in many applications. Users can set the maximum values for peak and continuous current as well as peak-current duration.

Copley Controls Corp. **Circle 420**



Instrument-Class Signal Conditioning...
From $180/Channel!



Superior Performance.

- ±0.05% Accuracy
- 1500Vrms Isolation
- True 3-Way Isolation
- Adjustable 0 and Span
- 240VAC Input Protection
- ANSI/IEEE C37.90.1-1989 Transient Protection
- Plug-In Terminal Blocks

Customer-Designed. You told us what you wanted in the next generation of isolated analog signal conditioning modules: DIN rail mounting, better performance and protection, all at lower cost.

And here it is - The new DSCA Series from Dataforth.

Sharper Signals. Don't leave valuable data in the field. Our DSCA modules give you superior ±0.05% accuracy (includes nonlinearity, hysteresis, and repeatability), ±0.01% linearity, and excellent stability over time so you get all the data acquisition, test, measurement, and control information you need to run your plant or process.

Safer Systems. All input, output, and power supply lines are protected against high level voltages and currents to keep your data and control system investment safe from noise, power surges, ground loops, shorts-to-ground, and other industrial electrical hazards.

Lowest Cost. Choose from 100+ DSCA modules, all offering 20% to 50% savings and much higher performance compared to similar functional modules in older designs.

DSCA30	Analog mV Input Modules, 3Hz BW
DSCA31	Analog V Input Modules, 3Hz BW
DSCA32	mA Input Modules
DSCA34	Linearized 2,3, Wire RTD Input Modules
DSCA36	Potentiometer Input Modules
DSCA37	Nonlinearized Thermocouple Input Modules
DSCA38	Strain Gage Input Modules
DSCA39	I Output Modules
DSCA40	Analog mV Input Modules, Wide BW
DSCA41	Analog V Input Modules, Wide BW
DSCA42	2-Wire Transmitter Interface Modules
DSCA43	DC Transducer Input Modules
DSCA45	Frequency Input Modules
DSCA47	Linearized Thermocouple Input Modules
DSCA49	V Output Modules

Call **800-444-7644** for more information or visit our website **www.dataforth.com.**

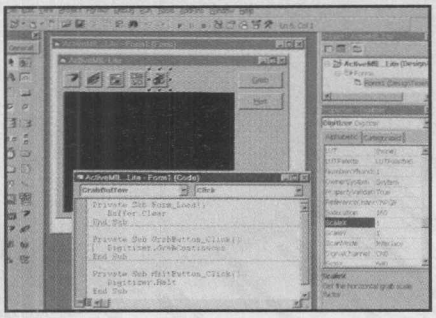
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PRODUCTS & SOFTWARE

Imaging Tools

Montreal, Quebec, Canada.—ActiveMIL-Lite is a collection of ActiveX controls for building Microsoft Windows-based imaging applications using rapid application



development (RAD) tools. These ActiveX controls for image capture, transfer, and display using Matrox frame grabbers and image processors gives developers access to the algorithms of the Matrox Imaging Library. To create applications, developers drag-and-drop controls from a toolbar onto a work space. Then they configure an application by selecting frame grabber settings from tab menus instead of coding.

Matrox Imaging Products Group
Circle 425

High Accuracy with Mini Encoders

Allerod, Denmark—Using the latest SMD and bonding technology, these miniature hollow shaft encoders are made with an outer diameter of only 24 mm, and are especially resistant to shock and vibration. They count 2,000 pulses per revolution and a maximum frequency of 200 kHz. Counting the leading and trailing edges of both channels provides four times the resolution, which means that the quadrature signal arrangement permits the 2,000 cycle encoder to deliver 8,000 pulseper-revolution. Scancon has made a wide range of spring couplings and flanges to make it easy for designers to mount the encoders on different motors.

Scancon A/S **Circle 444**

Imaging Tools

Montreal, Quebec, Canada—ActiveMIL-Lite is a collection of ActiveX controls for building Microsoft Windows-based imaging applications using rapid application development (RAD) tools. These ActiveX controls for image capture, transfer, and display using Matrox frame grabbers and image processors gives developers access to the algorithms of the Matrox Imaging Library. To create applications, developers drag-and-drop controls from a toolbar onto a work space. Then they configure an application by selecting frame grabber settings from tab menus instead of coding.

Matrox Imaging Products Group
Circle 425

AC Drive for OEMs

Rueil-Malmaison, France—The Altivar-58 is a new generation of sensorless flux vector controlled ac variable-speed drives with packaging options specifically for machine OEMs. The power range is from 0.37 to 15 kW. A completely equipped, ready-to-install version in an IP55 enclosure combines a circuit breaker, the Altivar-58, and an upstream contactor to isolate the motor from the drive.

Schneider Automation Circle 460



For information circle **180**

New Technology for Moisture Measurement



Berkshire, U.K.—The 4112 Dew Point and Temperature Transmitter measures moisture in processes where it has been previously impossible to do so because of temperature limits, contaminants, and harsh environments. The sensingelement combines a moisture sensor and platinum RTD at the probe tip and is designed to operate continuously at temperatures up to 165 °C. It eliminates the need for filtered environments, sampling of the process and disruptive "self-cleaning."

Honeywell Control Systems Ltd.
Circle 461

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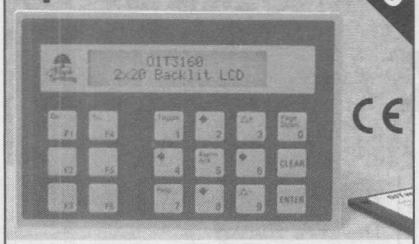
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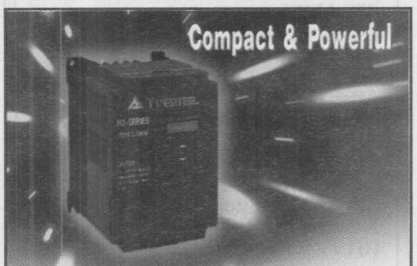
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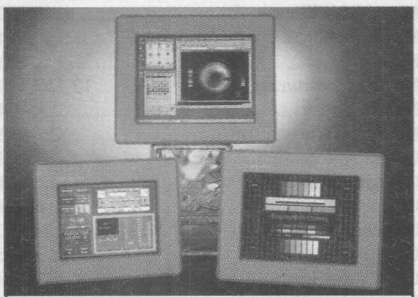
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BACK TO BASICS

How to Untangle Network Topologies

A topology, which is the pattern of interconnections among nodes, influences a network's cost and performance. While commercial networks move toward low cost solutions, industrial networks must concentrate on rugged, heavy-duty solutions for multiple environments.

This is achieved by using stronger signal integrity and heavier shields in the physical media. A topology determines what network characteristics are possible. What goes on top of that foundation, such as the physical media and transceivers, will determine network parameters.

Get on the bus

Most common is the bus topology. Bus adaptations are called linear bus, bus with extensive branching, and bus tree. These adaptations came about with specified electrical properties that allow longer drops and drops within drops. With all bus topologies, communications are conducted on common conductors where the receiver and transmitter are connected to the same communication wires as all other network nodes. This allows the transmission from one node to be received by all others.

Parallel network wiring is a great advantage. In many networks the nodes can be hot swapped in a bus configuration, an essential feature to some industrial process applications. Other advantages include low cost and easy installation. However, bus segment lengths are limited, and a network will fail if the main communication wires are cut. Some networks use repeaters to increase network length, and redundant communication cables ensure that a broken wire will not bring the network down. Examples of networks that use bus topologies include DeviceNet, Profibus, ControlNet, AS-i, and FOUNDATION Fieldbus.

Running rings

The second dominant form is ring topology, in which each node acts as a repeater. Transmission starts at a central station, usually the controller, and is sent to one node. That node receives the transmission, processes the information if needed, and sends it to the next node on the ring. Long networks are possible because each node reconditions the transmission; throughput time around the ring is predictable. When the ring breaks, communication is lost; hot swapping isn't possible. Interbus, Lightbus, and SERCOS are among networks using ring topology.

Trees combine

Bus and ring topologies are dominant in smaller fieldbus arenas. When a factory couples topologies together through gateways, routers, and bridges, the combination is called a tree topology. Large factories interested in keeping statistical data on processes will use a tree topology to gather information from different fieldbus controllers.

The Internet is the most common tree topology. Ways of using the Internet with control or supervisory systems are constantly being developed. Tree topologies interface with any topology as long a gateway exists, but that's also a disadvantage in many control systems. In gaining connectivity, the ability to determine the time it takes to receive information from a node is lost; generally throughput time is not a constant with a tree topology.

Star, mesh

Star and mesh topologies, because of higher costs, are not used widely. Star topology has one central node with a direct connection to each individual node. Because the protocol is easy to develop, many private networks use it. The mesh topology connects each node with every other node, creating an isolated data path between each node.

The first question when selecting a network should be: "Will the pattern of interconnection among nodes allow the network to physically achieve what's needed? Manufacturers of the network components can confirm network parameters.

Scott Holm-Hansen, InterlinkBT

Mr. Holm-Hansen (BS EE) is an electronics engineer in the Engineering Technologies Department of InterlinkBT (Plymouth, Minn.), a joint venture between Banner Engineering and Turck Inc. that specializes in fieldbus-related products.

Send comments to mhoske@cahners.com.



TERMS

Bus segment: A continuous communication line in a network.

Gateway, router, and bridge: Devices that are connected to multiple unlike network that make some kind of conversion so information may be exchanged. A gateway converts layers 1-6 on the ISO/OSI model (International Standards Organization/Open Systems Interface model), a router converts layers 1-3, and a bridge converts layers 1-2.

Hot swap: Ability to take nodes on and off the network without disrupting the network.

Repeater: A signal conditioner that connects one bus segment to another.

Throughput: The time it takes for a reaction (output) to an action (input) to occur on a network.

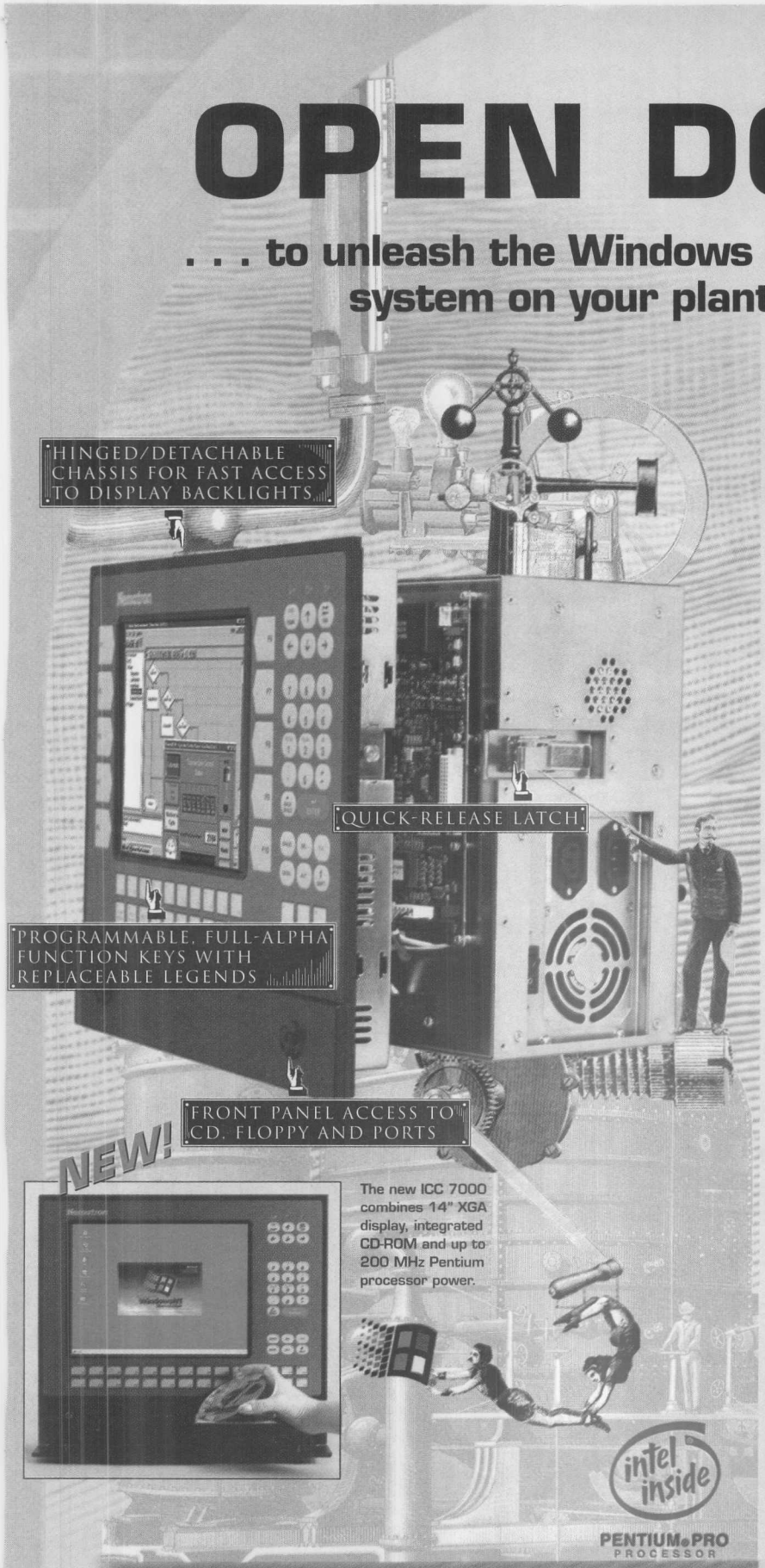
Topology: The pattern of interconnections among nodes.

Node: Any addressable device on a network.

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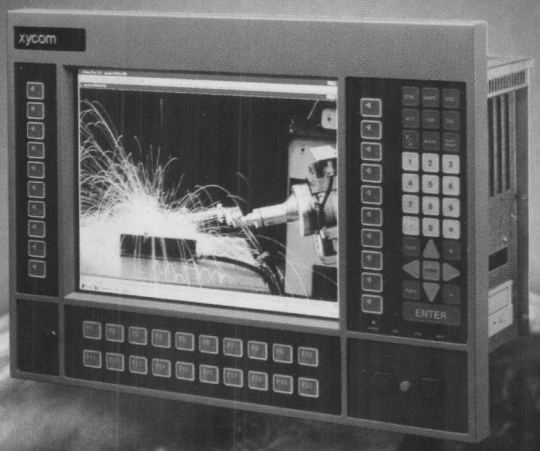
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